INTERAVIA

REVIEW OF WORLD AVIATION

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22nd Paris Air Show

Preview

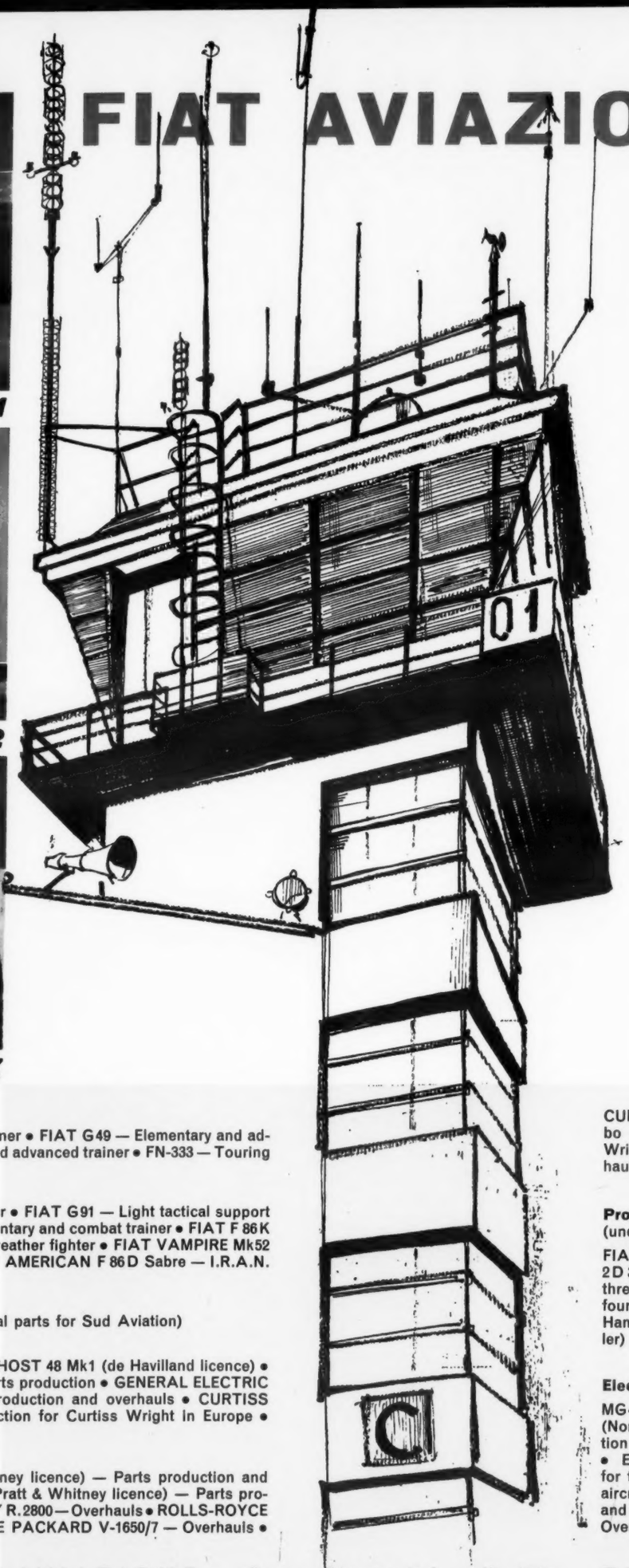
VOLUME XII 5 MAY 1957

FIAT AVIAZIONE

FIAT G 91

FIAT G 82

FIAT F 86 K



Piston-Engine Aircraft
FIAT G46 — Elementary and advanced trainer • FIAT G49 — Elementary and advanced trainer • FIAT G59 — Elementary and advanced trainer • FN-333 — Touring and executive amphibian.

Jet Aircraft
FIAT G82 — Elementary and combat trainer • FIAT G91 — Light tactical support fighter for N.A.T.O. • FIAT G91 T — Elementary and combat trainer • FIAT F 86K (North American Aviation licence) — All-weather fighter • FIAT VAMPIRE Mk52 (de Havilland licence) — Fighter • NORTH AMERICAN F 86D Sabre — I.R.A.N. overhauls.

Helicopters
SIKORSKY S-58 (production of mechanical parts for Sud Aviation)

Jet Engines
FIAT 4002 and its developments • FIAT GHOST 48 Mk1 (de Havilland licence) • ALLISON J35-A-29 (Allison licence) — Parts production • GENERAL ELECTRIC J 47 (General Electric licence) — Parts production and overhauls • CURTISS WRIGHT SAPPHIRE J65 — Parts production for Curtiss Wright in Europe • FIAT GOBLIN (de Havilland licence)

Piston Engines
PRATT & WHITNEY R.985 (Pratt & Whitney licence) — Parts production and overhauls • PRATT & WHITNEY R.1830 (Pratt & Whitney licence) — Parts production and overhauls. PRATT & WHITNEY R.2800 — Overhauls • ROLLS-ROYCE MERLIN 500 — Overhauls • ROLLS-ROYCE PACKARD V-1650/7 — Overhauls • CURTISS WRIGHT Turbo Compound (Curtiss Wright licence) — Overhauls

Propellers
(under Hamilton licence)
FIAT 5006 two-blade • 2D 30 two-blade • 23E 50 three-blade • FIAT 5010 four-blade — (modified Hamilton 24D 50 propeller)

Electronic equipment
MG4 Fire Control System (North American Aviation licence) — Overhauls • Electronic equipment for the F 86K and F 86D aircraft and other radio and electronic systems — Overhauls.

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INTERAVIA

Review of World Aviation

Volume XII **No. 5** **May 1957**

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Bird's eye view of the heart of Paris : Pont and Place de la Concorde and Chamber of Deputies ; in the rear the Eiffel Tower and the Grand Palais, scene of the first nineteen International Air Shows from 1909 to 1951 (photo : Pilote opérateur R. Henrard).

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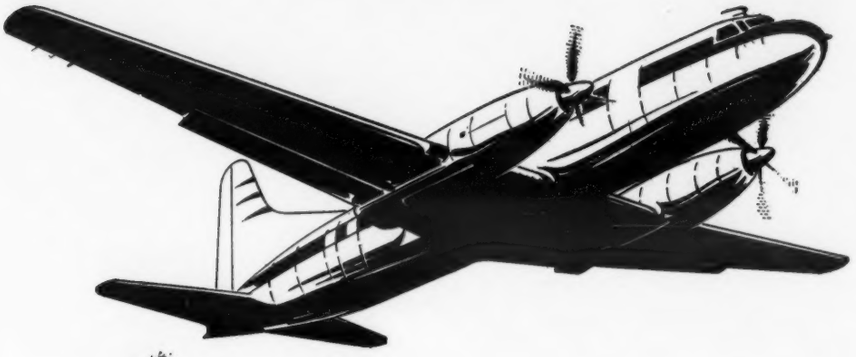

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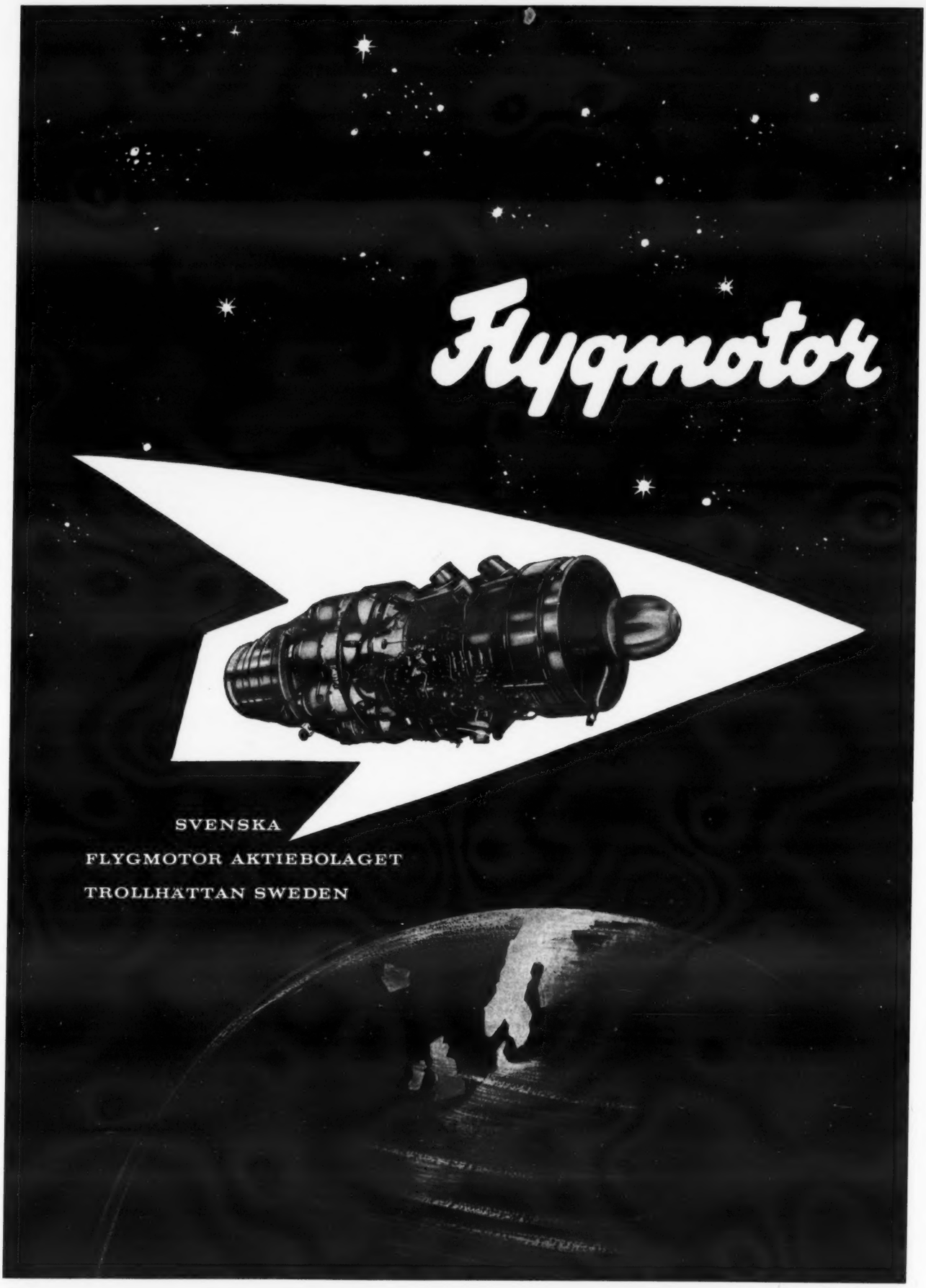
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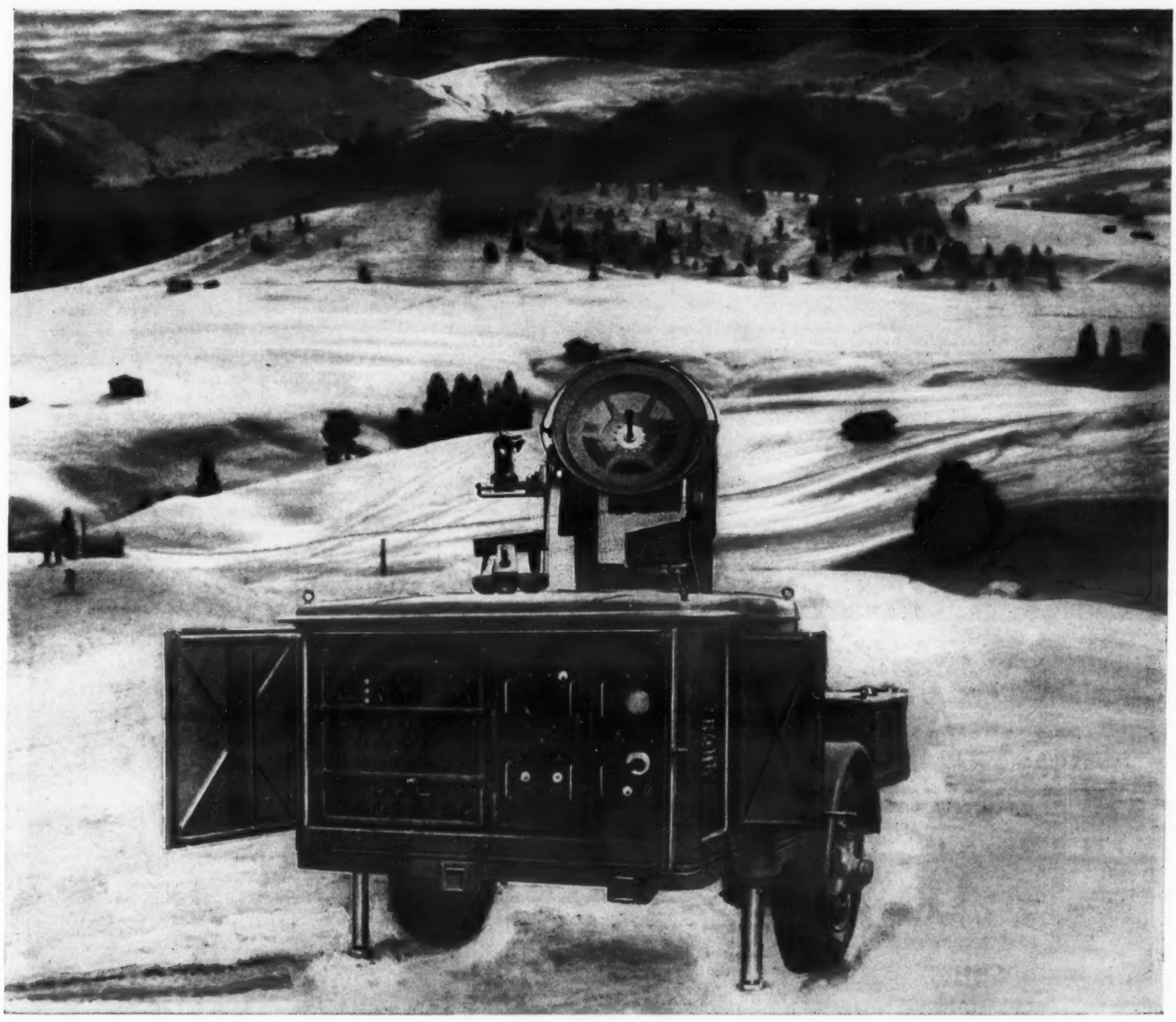

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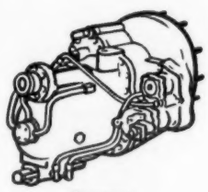

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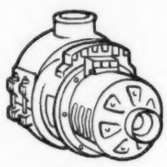

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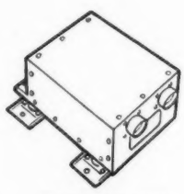

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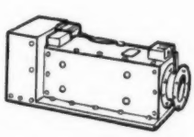

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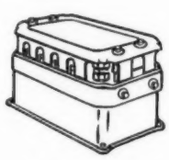

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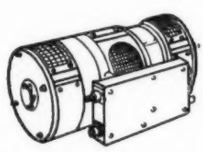

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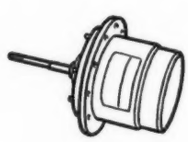

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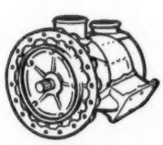

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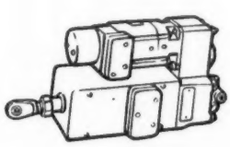
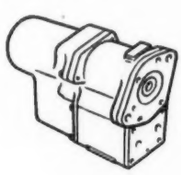


Linear Actuators



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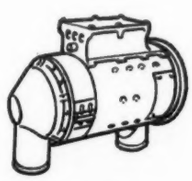

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the fastest aircraft over the longest distances is now in service on AIR FRANCE's long-range network

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37 years of experience and progress over the world's longest network

From Italy's Airports to the Whole World

In the ten years from 1947 to 1957 the aircraft of Italy's airlines have operated with constantly growing frequency over increasingly long distances, building up a logical and functional network of air services.

Besides connecting up the principal cities in Italy and serving nearly all European capitals, ALITALIA's and LAI's twin-engine and four-engine transports today reach out to North and South America; they connect Italy with North and South Africa, Central and East Africa; and fly to the Lebanon, Syria, Iran and Iraq in the Middle East.

Between 1947 and 1957 Italy's air services have made notable technical and commercial progress. The airlines' equipment has expanded from a few war-surplus aircraft to a carefully planned fleet of up-to-date, technically efficient transports. The year 1957 marks the beginning of a new phase in Italian air transportation through the introduction into service of two new aircraft types, the Vickers Viscount turboprop and the Douglas DC-7C. These aircraft will renew the high standard of the existing fleets and prepare the way for the introduction of jet transports.

ALITALIA-LAI traffic

	1947	1956	Change %
Km flown	2,086,223	19,350,440	+827
Flying hours	7,975	56,712	+611
Revenue passenger-km	31,783,431	447,591,335	+1,308
Revenue mail (tonne-km)	26,941	3,090,102	+11,370
Excess baggage, freight, newspapers (tonne-km)	311,433	7,326,358	+2,252
Total revenue tonne-km	2,816,349	52,390,981	+1,760
Network	13,329	87,776	+558

The Italian airlines, whose main traffic figures for 1947 and 1956 are given above have successfully completed the initial organizational and build-up phase, and are now preparing with the utmost care to meet the problems of the jet transport age, which will shortly be upon the whole world.

ALITALIA

LAI

Personally speaking

—a series of contributions on questions of the hour by leading aviation personalities.

A. V. CLEAVER, F.R.Ae.S.,
for many years one of the world's leading authorities on rocket propulsion, makes this contribution on . . .

Rockets, Astronautics, and the I.G.Y.

The current rising scale of activity in the fields of rocketry and astronautics is doing very much more than provide the creators of comic strips and other manifestations of " science-fiction " with background material. It is preparing the way for man's next great technological revolution, and perhaps the greatest adventure of all his exciting history—the conquest of space.

It seems to me so probable as to amount almost to a certainty that, unless our civilisation shortly destroys itself in another disastrous war, the supersonic rocket aircraft and guided missiles of this generation will gradually evolve into the spaceships of the next.

The most hopeful sign of all that the countries of the world may one day find it possible to co-operate for the peaceful achievement of space-flight is, I think, provided by the imminent International Geophysical Year of 1957-58, in which the U.S.A., the U.S.S.R., the U.K., France, and many other countries, will combine to spend some £100 million on pure scientific research into all subjects having a bearing on our knowledge of this planet and its atmosphere. This I.G.Y. will not, of course, be exclusively devoted to research with rockets ; however, quite a lot will be, for the most significant I.G.Y. project of all, in its promise for the future of astronautics, is undoubtedly the "Vanguard" satellite rocket. Although this will carry only a very small instrument payload, it is undoubtedly the forerunner of bigger future rockets, carrying bigger payloads, and eventually capable of attaining the full escape velocity (25,000 m.p.h.) from the Earth's gravitational field.

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LES TURBO-RÉACTEURS

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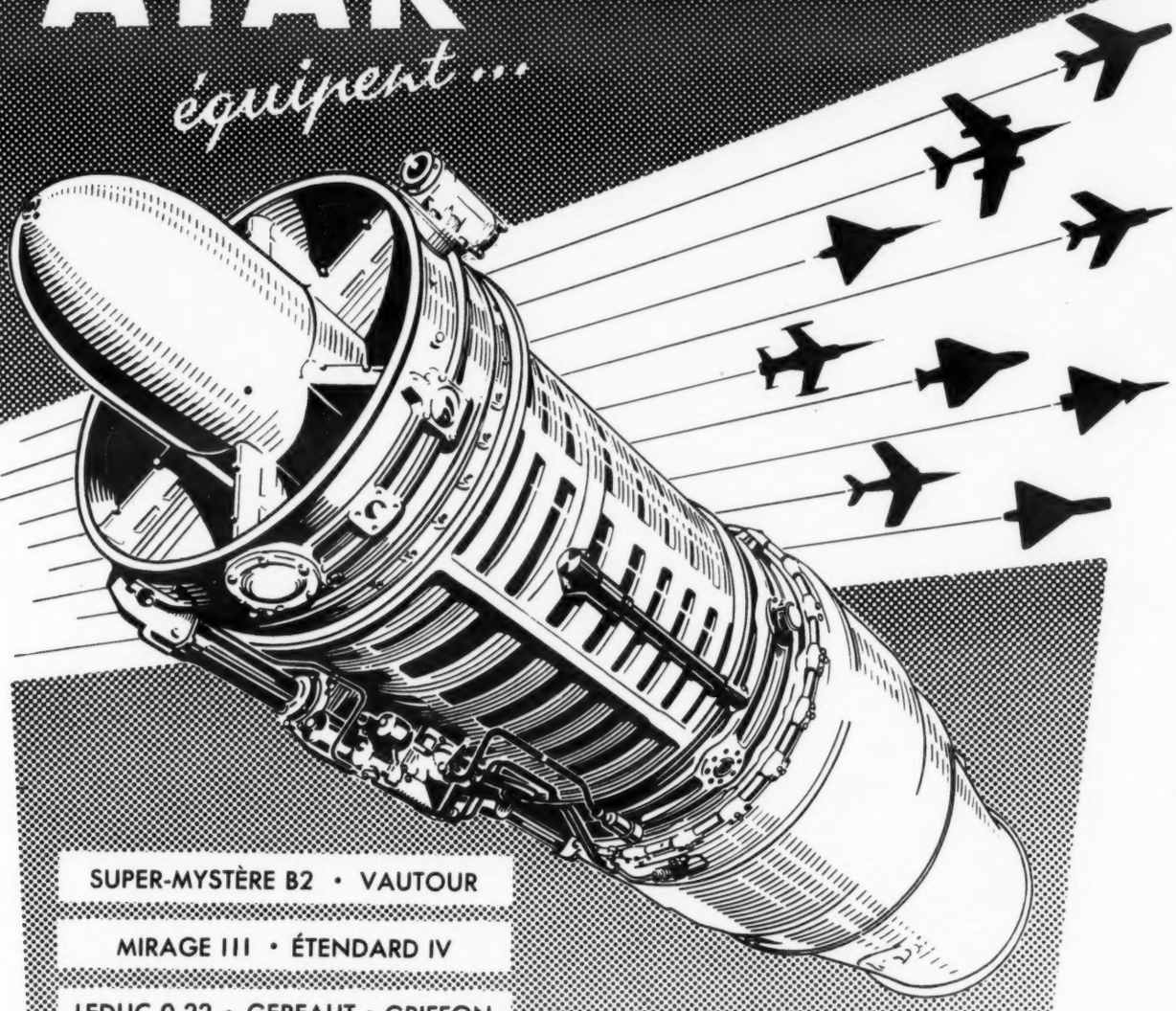

SUPER-MYSTÈRE B2 • VAUTOUR

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150, BOULEVARD HAUSSMANN PARIS-VIII[e]

PHOTOGRAPH OF LONDON AIRPORT BY COURTESY OF G.E.C. OF ENGLA

No runway problems for the Britannia

The Bristol Britannia can operate from existing runways at airports throughout the world. From a 6,000-foot runway it can lift a 28,000-lb payload, together with enough fuel for a sector distance of 2,500 miles including full allowances and reserves.

Powered by four 4,120-horsepower Bristol Proteus engines, the Britannia cruises at a guaranteed 400 mph and will carry up to 133 passengers. No other aircraft shows comparable economy over such a wide variety of stage lengths.

In fact, remarkable economy is maintained over its whole range of 200 to 6,000 miles, coupled with unrivalled standards of passenger comfort even in high density configurations. Britannias are now in commercial service with British Overseas Airways Corporation.

BRISTOL
Britannia

BRISTOL AIRCRAFT LIMITED

The following operators have ordered Britannias:

British Overseas Airways Corporation
El Al Israel Airlines
Canadian Pacific Airlines
Ministry of Supply
Royal Air Force Transport Command
Hunting-Clan Air Transport
Northeast Airlines

V12
5

MAY

5
7

XUM

INTERAVIA

Deadline Notes

No. 5, 1957

THE L.A.I.-ALITALIA MERGER is expected to be officially announced on May 31st. According to reports from Rome, the original idea of liquidating both companies and founding a new airline has been dropped in favour of a straightforward merger. Trans World Airlines, which holds 30% of L.A.I.'s capital, has announced its intention of withdrawing from the combined company. B.O.A.C. and B.E.A., however, which together own 30% of the stock in Alitalia, will not follow this example. Meanwhile it has been revealed that Engineer Bruno Velani, Managing Director of Alitalia, has been chosen for the post of Managing Director of the merged company.

UNION AEROMARITIME DE TRANSPORT and Olympic Airlines have signed an agreement on mutual cooperation. Olympic Airlines becomes agent for U.A.T. in Greece, and the French operator will represent the new Greek company in France, the French Union, Rhodesia and South Africa. U.A.T. will also place DC-6Bs at the disposal of Olympic Airlines until the latter takes delivery of its own DC-6Bs. This will enable Olympic to increase the frequency of flights on the Athens-Rome-Paris-London route from two a week to four as from June 1st, and to employ DC-6Bs instead of DC-4s.

TRANS-CANADA AIR LINES has ordered 13 additional Viscount 700s, which will bring its Viscount fleet up to 51 by June 1958. T.C.A., which inaugurated Viscount service in April 1955, now operates 24 of these aircraft. - Another Viscount order, for 5 aircraft, has been received from the Brazilian company VASP.

K.L.M. ROYAL DUTCH AIRLINES will take delivery of the first of nine Vickers Viscount 803s about the middle of May. The aircraft will be used on K.L.M. routes to Paris, Stockholm, Manchester, Dublin, Rome, Brussels, Barcelona, London, Copenhagen and Zurich.

AIR FRANCE has experimentally equipped one of its L-1049 Super Constellations with loudspeakers from which music will be broadcast to passengers in flight. The SE.210 Caravelle prototype now touring America is similarly equipped.

"GLOBAL NEWS" is the name of a new monthly published by Scandinavian Airlines System. It contains reports and pictures illustrating the company's activities in many parts of the world.

BERLIN-SCHOENEFELD, home base of the East German Lufthansa, is the terminal for 20 flights a week to Moscow, 21 to Prague, 13 to Budapest, 10 to Warsaw, 6 to Bucharest, 6 to Sofia, 6 to Paris and Brussels, 3 to Copenhagen, 3 to Stockholm, 2 to Helsinki and 2 to Vienna.

TRANS WORLD AIRLINES DIRECTORS have voted to make a direct common stock offering to holders rather than resort to the issuance of convertible notes or debentures (see under "What's in the Air?" in this issue). The company is going ahead with arrangements to obtain $50,000,000 from institutions, on the security of T.W.A. aircraft. Stockholders have approved a proposal to increase the outstanding common stock from 4,000,000 to 10,000,000 shares, and the directors set a tentative rate of a share-for-share exchange, which would result in the issuance of 3,337,036 new common shares. Hughes Tool Company, which owns 74% of T.W.A.'s common stock, would agree to buy enough of the new shares to net T.W.A. not less than $34,000,000.

TRANS WORLD AIRLINES opened a weekly freight and mail service between Geneva and New York, via Paris and Shannon, on May 4th. The service, to be known as "Cargo Express", will be mainly destined for shipments of the Swiss watch industry, but bulky loads and live animals will also be accepted. The flights will leave Geneva-Cointrin every Saturday night. DC-4s transports will be used.

TRANS AMERICAN AIRLINES, formerly known as North American Airlines, and the largest non-scheduled airline in the United States since 1949, will go out of business on June 5th. The U.S. Supreme Court has refused to change an Appeals Court decision to uphold revocation by the Civil Aeronautics Board of the company's operating certificates.

DAIMLER-BENZ A.G. has signed an agreement with Curtiss-Wright Corporation and Studebaker-Packard Corporation to set up an American company to be known as Curtiss-Wright and Mercedes-Benz, Inc., and to provide for the development and sale of Daimler-Benz products in the United States, Canada, Mexico and Cuba. Studebaker-Packard has been granted exclusive distribution and sales rights for Mercedes-Benz cars in the United

* From INTERAVIA's world-wide news service, including INTERAVIA AIR LETTER, the daily international aviation news digest. — No part may be reproduced without written permission.

States and Canada. The Utica Bend division of Curtiss-Wright, which is now building diesels for the U. S. Navy, will import, manufacture and sell Mercedes-Benz diesel engines - ranging from 25 h.p. to 600 h.p. - and diesel and gasoline engine fuel injection systems. Further agreements are being negotiated between Daimler-Benz and Curtiss-Wright for the interchange of rights for the manufacture of aircraft products.

CANADAIR LIMITED has obtained the right, under an agreement with Bristol Aeroplane Company, to produce and sell the following "North Americanized" versions of the Britannia: 1) a freighter with two big doors and strengthened floor. Canadair has exclusive sales rights everywhere except in Britain. 2) A military transport, the CC-106, already ordered by the R.C.A.F. Exclusive rights in Canada, with the right to compete with Bristol in Scandinavia, Switzerland and Argentina. 3) A civil airliner. Canadair has exclusive rights in Canada except for Canadian Pacific Airlines' option on Britannias, and the right to compete with Bristol in the United States, Scandinavia, Switzerland and Argentina. 4) The CL-28 Argus anti-submarine aircraft. Exclusive world rights, including Britain.

INTEREST IN THE CARAVELLE is being shown by Aerolineas Argentinas, Transcontinental and Lineas Aereas del Estado, all of Argentina. The Brazilian airline Varig is also considering the purchase of five Caravelles.

TELEPHONE SERVICE FOR AIR TRAVELLERS has been approved by the Federal Communications Commission. The Bell Telephone Company will establish a limited service in the Chicago-Detroit areas available to persons flying in aircraft within a 50-mile radius of the two cities. Commercial airlines as well as private aircraft will be able to avail themselves of the service. Rates for a three-minute call will range from $1.50 to $5.25, depending on the location of the aircraft and the ground connection.

A NEW SYSTEM OF RESEARCH MISSILE RECOVERY, developed at the Woomera test range, is an adaptation of mine-sweeping techniques to aerial use. A winged paravane is floated out from the side of a fighter aircraft like a kite, attached by a 400 to 500 ft. cable. As the missile drops on its parachute at the end of the run, the fighter chases it and catches the parachute lines across the cable, where it runs out to the paravane and is held. At the base the missile is "collected" from the paravane on a cable or in a net slung between two towers, as the fighter flies past. The United States is said to be interested in the system, which reduces damage to expensive test vehicles and their instrumentation.

TRANS-CANADA AIR LINES have exercised an option to increase their original purchase of four DC-8s to a total of six, all of them to be powered by Rolls-Royce Conway engines. Delivery of TCA's DC-8s will begin late in 1959. - According to a Douglas Aircraft Co. release, TCA's reorder raises the announced total of DC-8s sold to 121.

THE U.S.A.F.'s NUCLEAR POWERED BOMBER PROGRAMME has been slowed down and only about one quarter of the $600,000,000 which were originally to have been spent on the project in the next fiscal year will be used.

*

WORKSHOP BRIEFS . . .

A supersonic ejection seat which projects the pilot feet first out of the cockpit has been developed to ICESC (Industry Crew Escape Systems Committee) recommendations and under the supervision of Convair. Models of the seat have already been submitted to extensive wind tunnel tests, and full-size versions are shortly to be tested at the U.S. Air Force's rocket sled tracks at Edwards AFB, California, and Hurricane Mesa, Utah. * The de Havilland Comet 4s and Comet 4As for Capital Airlines will have noise suppressors and thrust reversal devices. * A number of projects for STOL light transports and executive aircraft are being prepared in Britain (including one by de Havilland). * A navigation trainer version of the Avro Shackleton four-engine naval patrol aircraft bears the designation T.4. * The Nord 3202 two-seat trainer (240 h.p. Potez 4 D 32 engine) has begun flight testing. Seats in tandem; suitable not only for elementary training, but also for aerobatic, navigation and instrument training. * Sud-Aviation has scheduled October 15th, 1957 as date for the first flight of the SO.4060-001 supersonic bomber. Fitted with two SNECMA-ATAR G jet engines. * The Dassault Etendard IV has exceeded a speed of 630 knots in level flight near the ground. * An improved version of the Tupolev Tu.104 jet commercial transport, with accommodation for 70 passengers, is reportedly to go into service shortly. * Turboboxcar is the new designation of a version of the Fairchild C-123 assault transport with four turboprop engines. A prototype is to be ready for flight testing in 1958. * Aeromarker, an optical marking aid for the visual tracking of target drones, guided missiles or research aircraft at high speeds and at altitudes of up to 60,000 ft., has been developed by Aerojet-General Corporation, Azusa, California. Aeromarker emits a bright flash of light and a dense puff of smoke, which is radar reflective and, under certain conditions, attractive to infrared seekers. * Spain's ENMASA Flecha 90 h.p. flat-four engine has completed its official certification tests at the Instituto Nacional de Técnica Aeronautica. * SIPA 1200 is an all-metal target drone with delta-wing built by France's Société Industrielle pour l'Aéronautique. * TM-61C, a new more efficient version of the Martin Matador tactical missile, will shortly be delivered to the U.S. Air Force units, in part as replacement for older versions.

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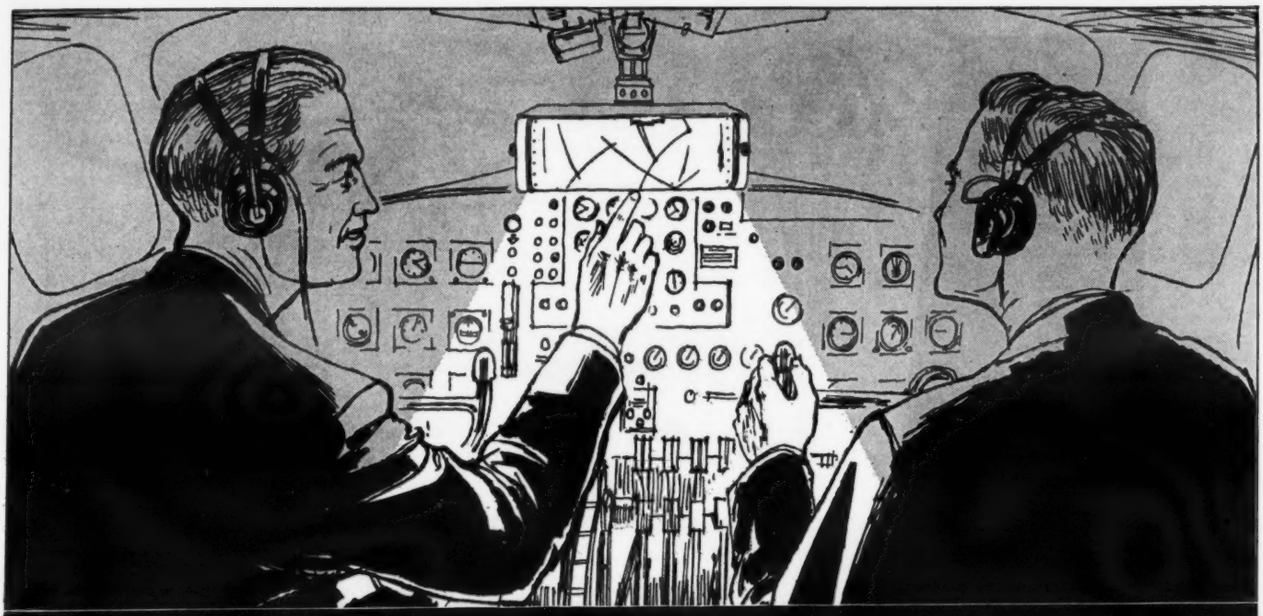
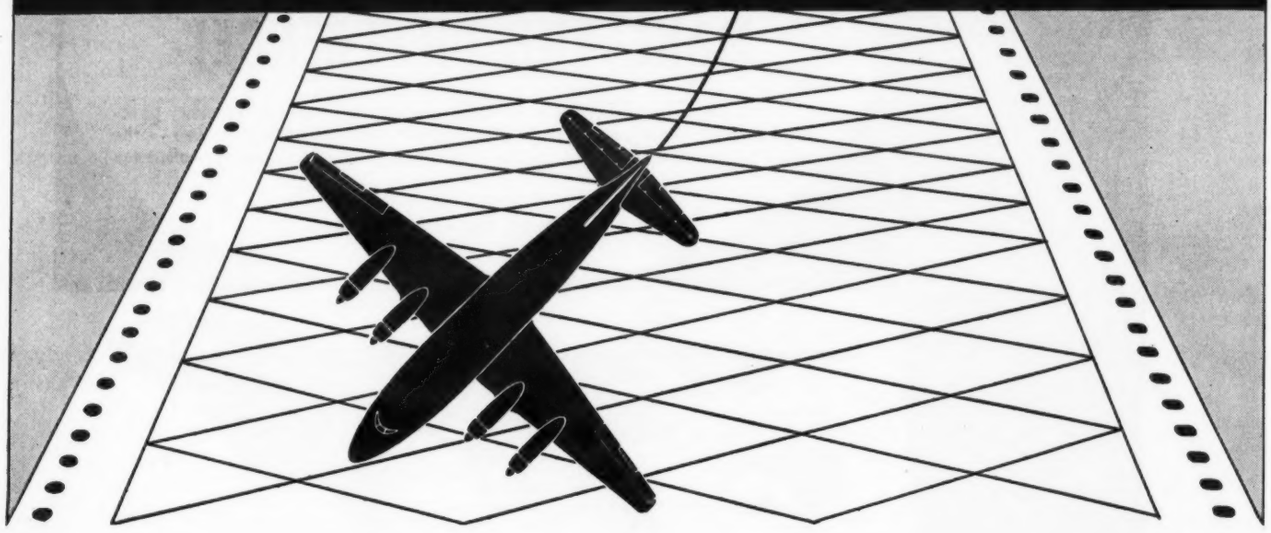


"Decca – I wouldn't fly without it..."



...fantastically accurate—didn't believe it at first... see exactly where you are all the time—in any sort of weather. That's the Flight Log, shows exact position all the way from Take Off to Touch Down, on the deck too for that matter—I hear they're even thinking of fitting the fire engines at L.A.P.

It's the only thing that gives you a constant check on wind... you can get a spot-on ground speed too, makes all the difference in calculating ETAs... much more popular with ATC—on track all the time, and arrive on the dot... makes holding and approach procedures a piece of cake, although I don't seem to have had many delays since we fitted Decca.

Useful in emergency too—remember that Bordeaux do last year when they just made the coast on Decca... made quite a fuss about it at the time... seems to me with the ever increasing numbers of aircraft it would be a lot safer if everybody used Decca.

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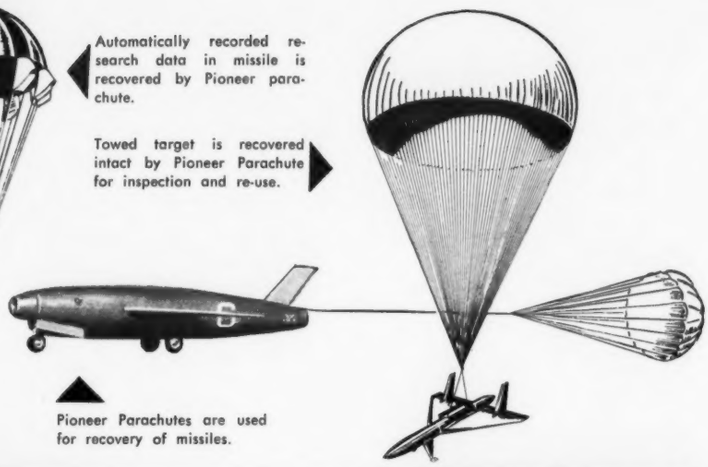
Towed target is recovered intact by Pioneer Parachute for inspection and re-use.



Pioneer Parachutes are used for recovery of missiles.

P9-B in descent straight down.

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In life saving parachutes, in cargo parachutes, in missile recovery parachutes, in jet plane brake parachutes — wherever parachutes are used — the name Pioneer is symbolic of *quality craftsmanship* and *engineering proficiency*

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P-T-10 — Latest troop parachute — 35 ft. diameter canopy.

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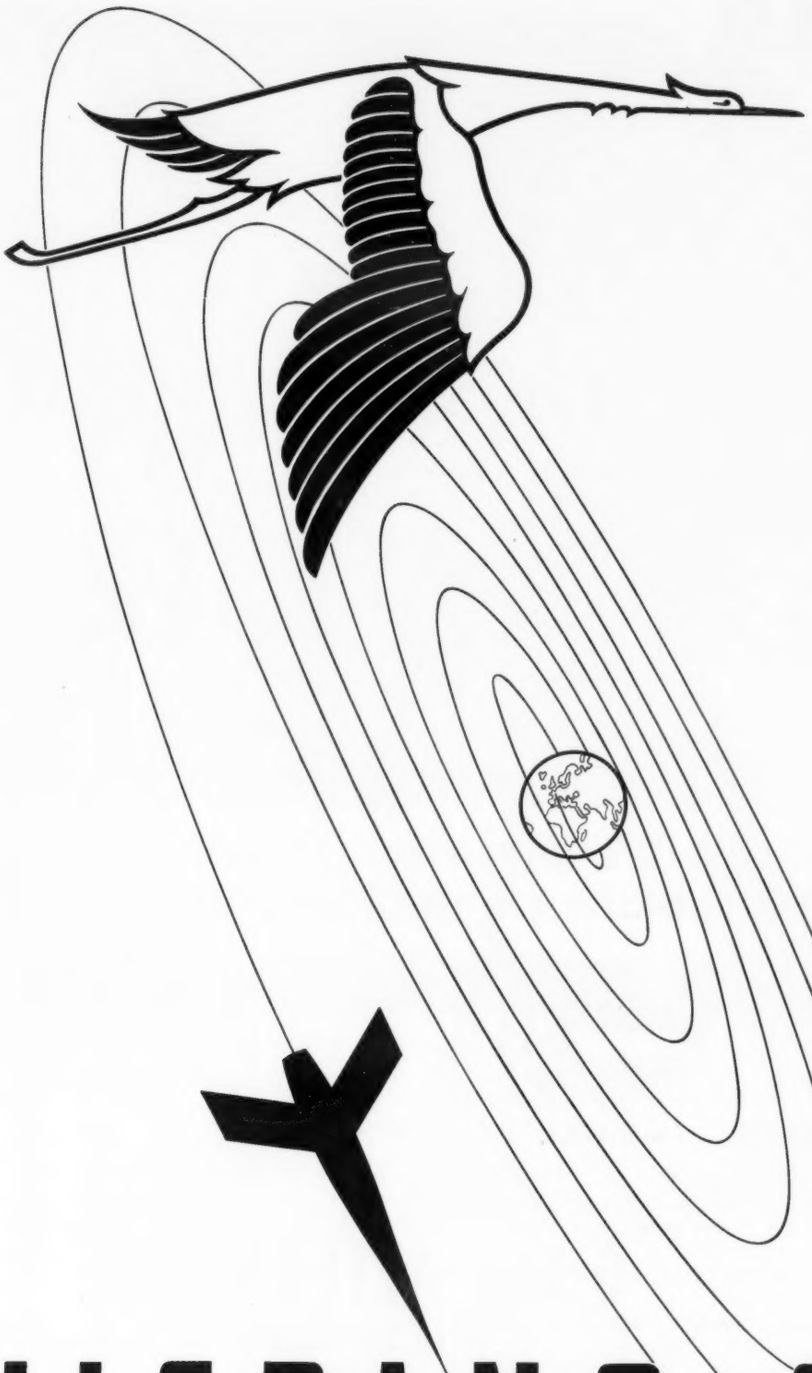

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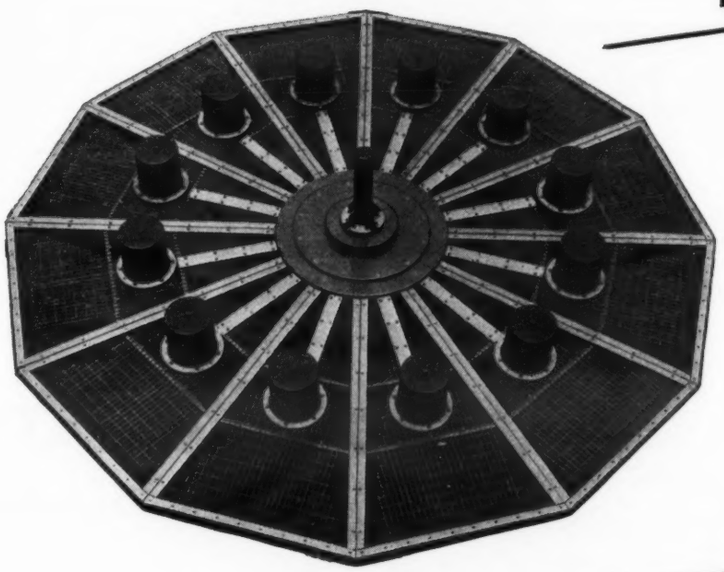

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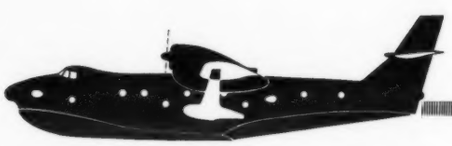
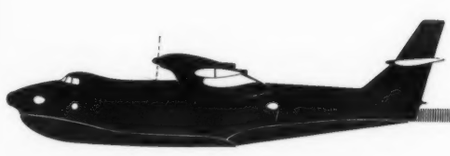
P. 149-D 4/5-SEATS
Touring aircraft and trainer

P. 136-L AMPHIBIAN
Twin-engine five-seater

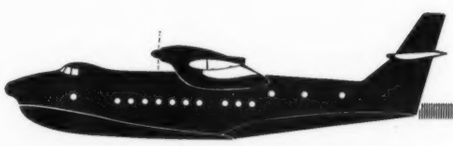
P. 166 6-8 SEATER
Twin-engine landplane



P. 155 SAM-1 AMPHIBIAN
Air-sea rescue



P. 155-AS
Anti-submarine aircraft



P. 155-CT
20 to 30 passengers

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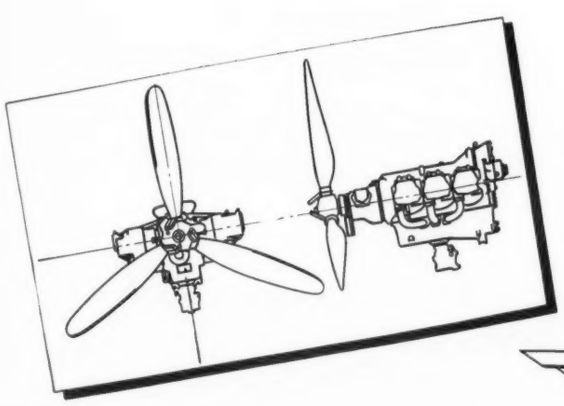
Piaggio Propellers



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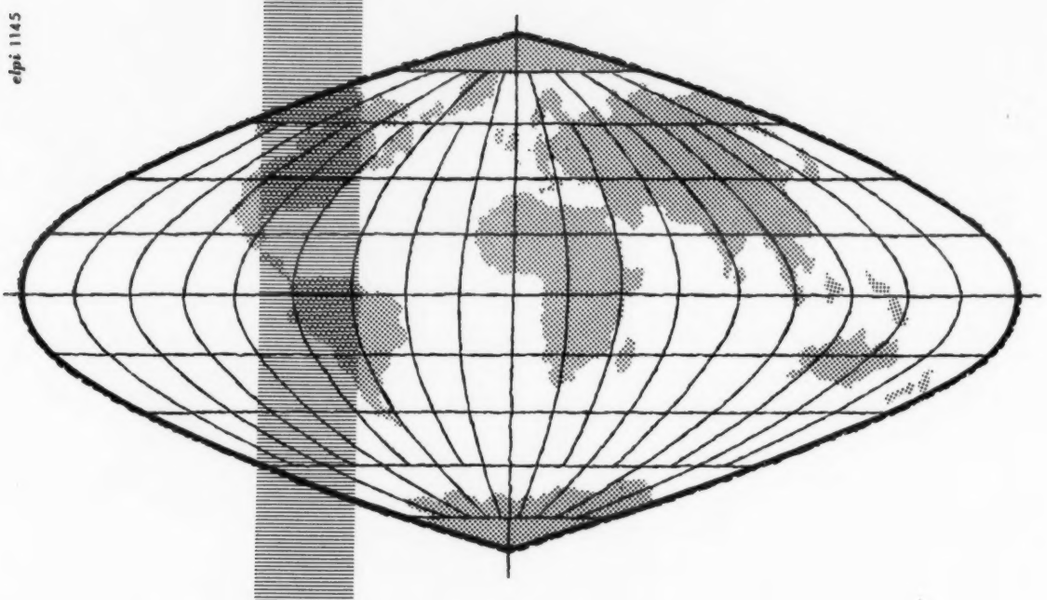

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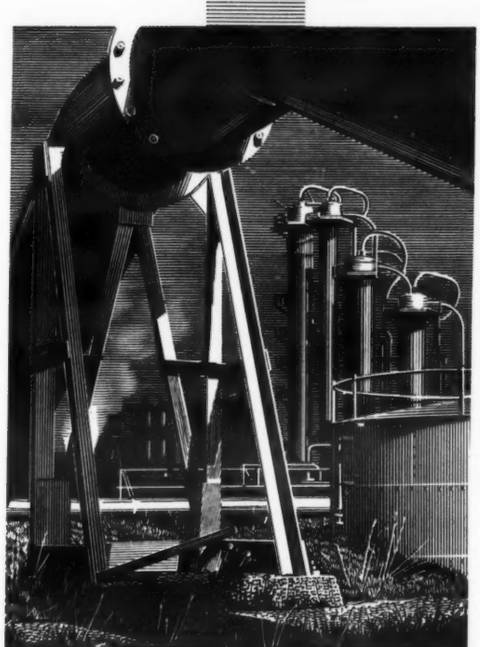

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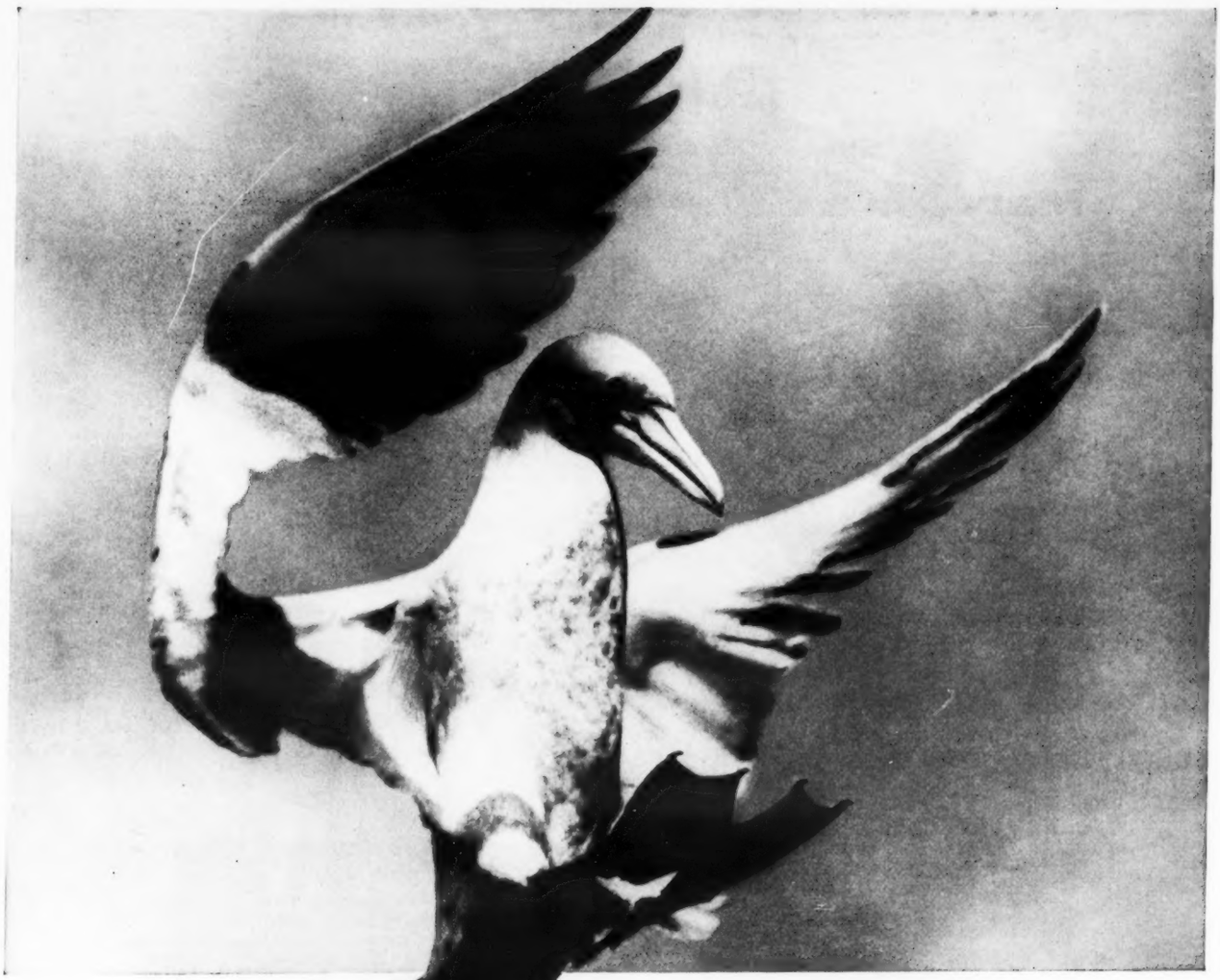

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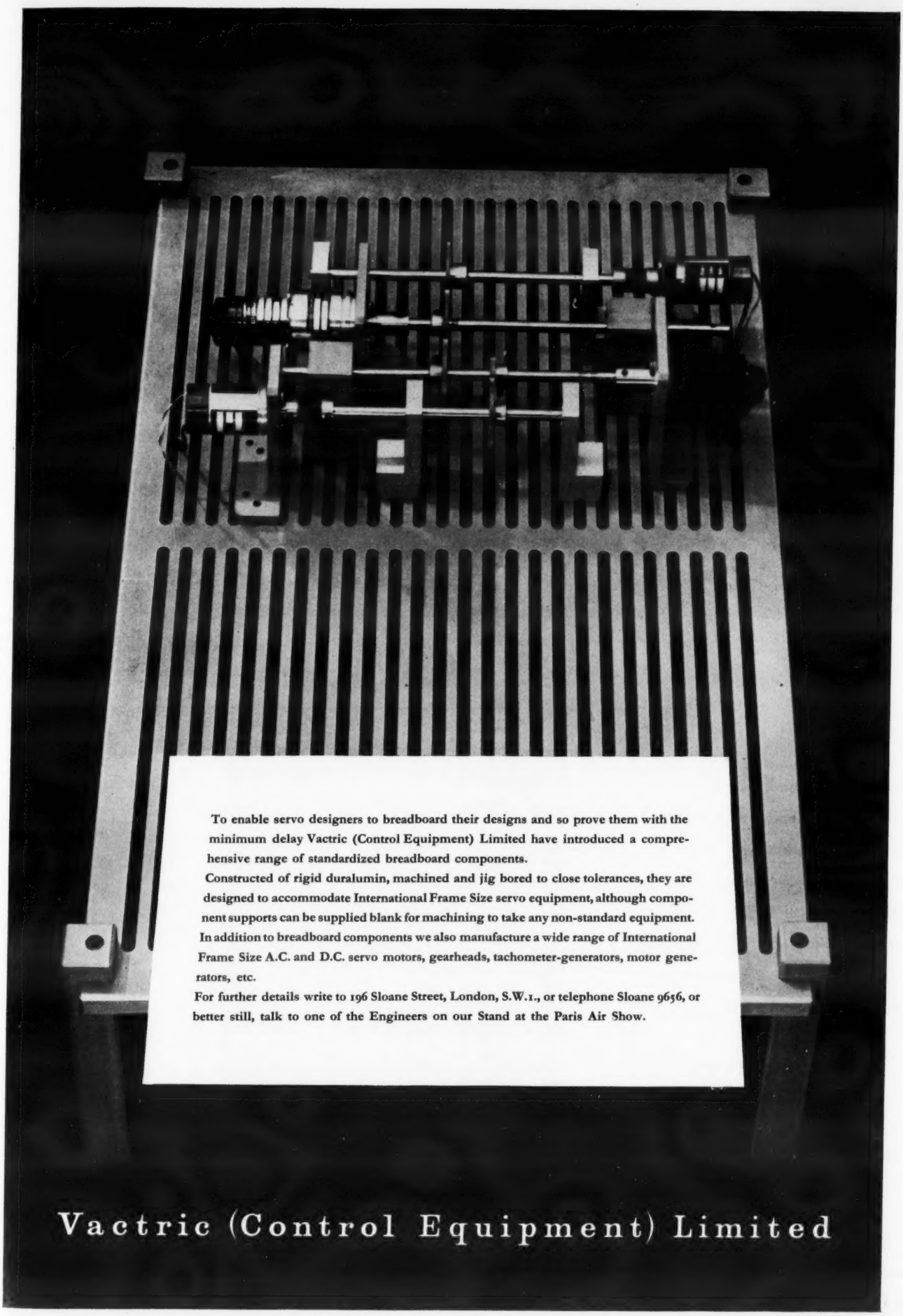

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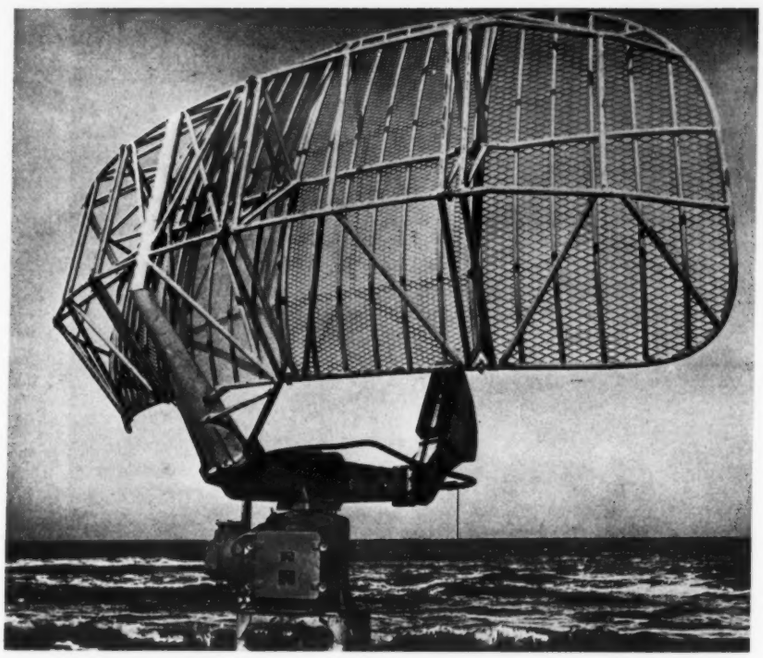
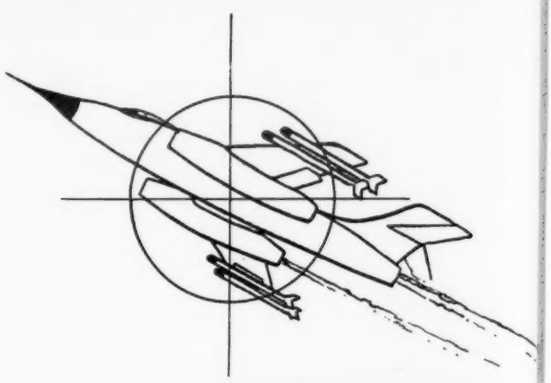
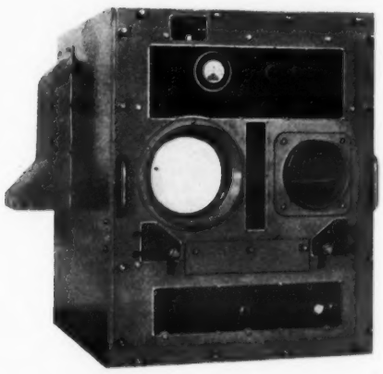
Vactric (Control Equipment) Limited

microlambda

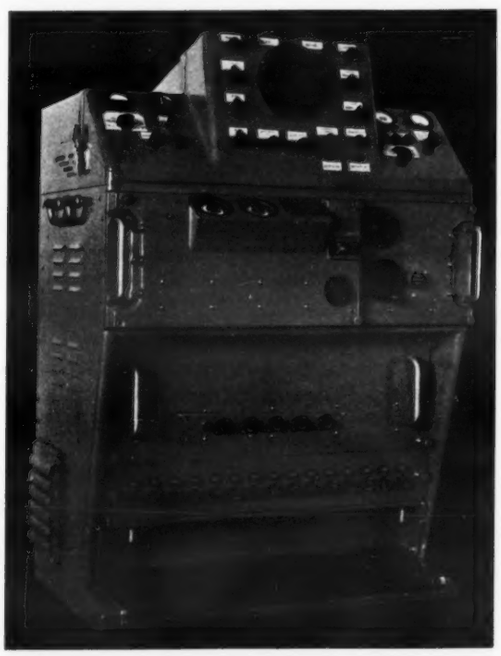


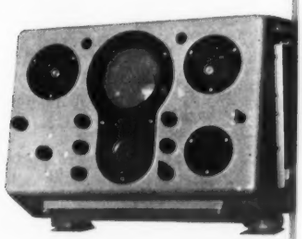




MLA-1 air surveillance radar for naval use

Among the most recent projects developed by the Research and Development Laboratory at Microlambda are the two radar equipments shown here. Microlambda has begun quantity production of them for the Italian forces and for other European and non-European countries.





MLT-4 anti-aircraft fire control radar for naval use

MICROLAMBDA - VIA FERDINANDO DI SAVOIA, 6 - ROME - PLANT AT FUSARO (NAPLES)

Spare landing gear ordered by Douglas Field Service representative being offloaded from giant C-124 at Polar Base.

Douglas Field Service follows Douglas airplanes to the bottom of the world

Planes on right are Navy R4Ds and R5Ds, first airplanes in history to land at the South Pole. At the left is an Air Force C-124 Globemaster.

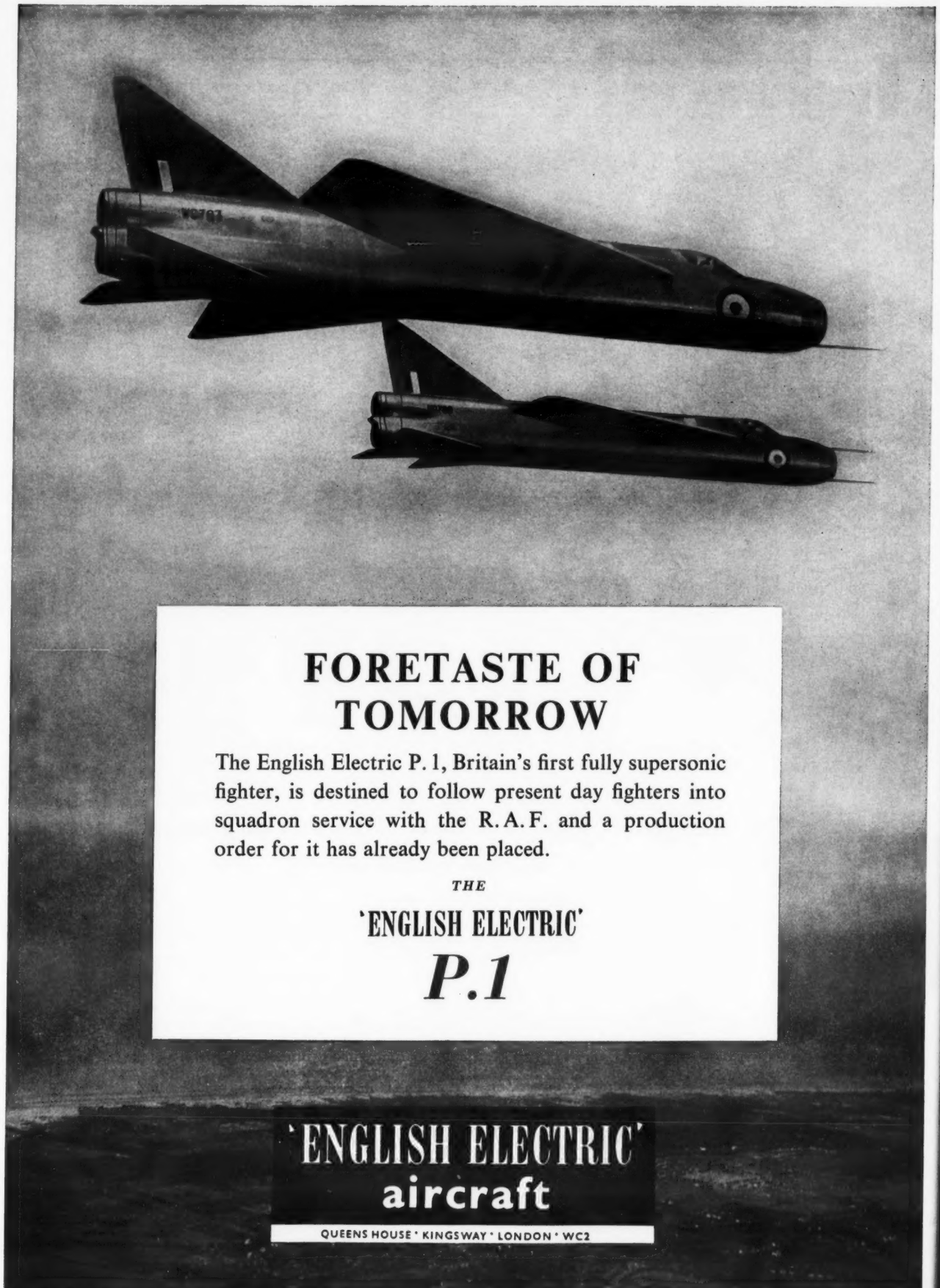
When "Operation Deepfreeze" used Douglas R4Ds, R5Ds and C-124s as key supply and support aircraft at the South Pole, a Douglas Field Service representative went along. Working with the Air Force he established a pipeline for immediate delivery of replacement parts and assisted in their installation as required.

Wherever Douglas airplanes or missiles may be, whether their mission is military or commercial, Douglas Field Service men are on hand to do everything possible to facilitate their maximum utilization. Douglas backs its equipment with service and spare parts on a permanent basis, years after its delivery to the customer.

Depend on

DOUGLAS

Service



FORETASTE OF TOMORROW

The English Electric P. 1, Britain's first fully supersonic fighter, is destined to follow present day fighters into squadron service with the R. A. F. and a production order for it has already been placed.

THE

'ENGLISH ELECTRIC'

P.1

'ENGLISH ELECTRIC'
aircraft

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PARTNERS IN PROGRESS WITH MARCONI'S AND NAPIER IN THE ENGLISH ELECTRIC GROUP

Why Paris?

22nd International Air Show — May 24th to June 2nd, 1957

Fore more than a year "My Fair Lady", the musical based on Bernard Shaw's "Pygmalion", has been playing every night at New York's Mark Hellinger Theater. Every night would-be playgoers line up at the booking office, but most of them are turned away empty-handed. On the day before my departure from New York thoughtful friends sent me a gift of long-playing records, including "My Fair Lady". But when I got home, my wife was disappointed with them. She much preferred the fifty-year-old "Merry Widow" sung by Elisabeth Schwarzkopf and announced that she was not at all impressed by all my tales of the United States.

That's just how it is with Paris, with the International Air Show. This too has been taking place for nearly fifty years and has become a permanent fixture which nobody would like to be without. None of the New World's engineering progress or organizational gifts can put Paris in the shade. May in Paris! Visions of restaurants, theatres, museums, evenings in the Bois de Boulogne, Paris night life for the untiring, the shops in the Rue de la Paix or the Faubourg St. Honoré for the ladies... in short everyone is glad of an excuse to spend a few days in the city on the Seine.

*

According to all the signs, the Paris Show promises to be an especial success this year. In 1955 only seven countries were represented: this time eleven countries are showing at any rate some of their products.*

In 1955 the whole atmosphere of the Show was influenced by the presence of N.A.T.O. headquarters in Paris. Though this fact still draws both exhibitors and visitors, it is certainly not what has brought the Poles and Czechs here.

In 1955, Theo Blank, at that time German Defence Minister, visited the Show more or less *incognito,* and the German officers led by General Hans Speidel, who had just been appointed delegate to S.H.A.P.E., remained pointedly in the background. Today this same General is Commander-in-Chief, Allied Land Forces, Central Europe.

Time never stands still... What advances are made become abundantly clear every two years when the Paris Show opens its doors. Last time there were still plenty of piston-engine aircraft to be seen; this time the turbine, with or without propeller, reigns supreme. Meanwhile, the airlines, too, have gone over wholeheartedly to its cause.

As the balloons of the first Show in 1909 gave place to the "heavier-than-air" machine, so this year it is rockets that will be the main attraction on many stands. How many visitors to the early post-war Shows had any vision of the influence electronics would so soon exert on the whole development of aviation? Stands showing electronic equipment become increasingly bigger and more numerous. Altogether there are 217 exhibitors this time, and more than 60 aircraft will be lined up on Le Bourget airport, ready to show their paces during the flying displays on June 1st and 2nd. And then there are the many helicopters.

*

André Granet, the real father of the Paris Air Shows, who organized the first Show, has decided to withdraw from active participation in future. Nobody would guess how old this youthful-looking man really is, and we shall not be so indiscreet as to reveal his age. Parting with so old a friend is hard. We wish him an honourable retirement... but somehow do not entirely believe he will be able to retire altogether. Even if he comes to the next Show only as a visitor, his stamp will be upon it.

And now we pass the word to André Granet himself.

EEH

Programme of the 22nd Paris Show

Le Bourget, May 24th to June 2nd, 1957

May 24th *Official opening.*

May 26th *Commercial and sports aviation day, with the participation of numerous international airlines. Demonstration of commercial transports, sports and touring aircraft.*

May 30th *Helicopter day, to be known as "Louis Breguet Day", in memory of the first vertical take-off by a Breguet design in 1907. Demonstration of a wide variety of helicopters.*

June 1st *Grand flying display for guests of the* Union Syndicale des Industries Aéronautiques. *Television transmission to eight European countries. The public will also be admitted to the display.*

June 2nd *International flying display open to the public.*

Special flight demonstrations will be made daily during the Show. There will also be a helicopter shuttle service between Issy-les-Moulineaux heliport and Le Bourget.

In addition, a number of technical congresses will be held, for example by O.N.E.R.A. and I.C.A.O.

Inside the Grand Palais at the first Paris Show in 1909.

Entrance to the now traditional International Air Show at Le Bourget Airport, Paris.

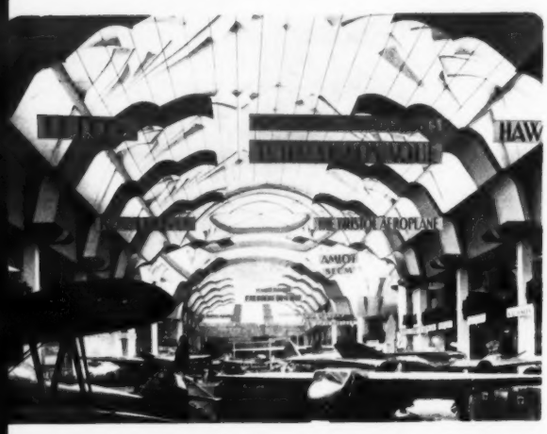
* Belgium, Canada, Czechoslovakia, Germany, Italy, Netherlands, Poland, Sweden, United Kingdom, United States, and France as host. The official announcement even mentions 13 countries; but Austria's contribution is still a mystery, and Israel merely has a stand for its purchasing commission.

The 22nd International Air Show

A Half Century in the Service of Aviation

By André Granet, Secretary-General, Paris Air Show

1919: The exhibition in the Grand Palais reflects the technical impetus of World War I.



1936: Some of the names of countries and companies which disappeared from the Salon in the years following World War II will be seen in Paris again this year.

1955: From the ornateness of the Grand Palais to the functionalism of the static show at Le Bourget.

Having been invited to write a few words on the 22nd International Air Show, I should like first of all to call attention to the date of the Show which, to my mind, calls for some celebration.

It is now almost fifty years since France's *Chambre Syndicale des Industries Aéronautiques* was founded and the first International Salon devoted exclusively to aviation was held.

The Editors of *Interavia* thus showed themselves well aware of the significance of this year's Salon when they asked me to take stock, as from one of those commanding positions from which guides show us the path already covered and the road to come.

Looked at from this detached viewpoint, the story of aviation may be seen to cover three phases, the first of disappointment, the second of militant progress, the third of triumph.

The first phase, of hopes and dreams, began with the Daedalus legend and lasted for thousands of years up to the beginning of our century.

The second phase, which also embraces the contemporary period, is that of conquest; it is now drawing to a close and will have lasted half a century.

It is to this militant phase in aviation, the story of which began at the Auvours camp with the first crossing of the Channel and is approaching its end in the din of the sound barrier, that the 22nd Salon is dedicated. This conquest of the air has been no easy matter, but has demanded a vast sum of courage, sacrifice, tenacity and, last but not least, genius.

The pictures on this page were taken at some of the earlier Shows, originally in the Grand Palais and later, from 1951 onwards, at Le Bourget. They provide clear landmarks along the road already trodden.

There were five Shows before World War I, twelve between the two wars, and five since 1946. Each reflected the capabilities of the aircraft industry at the time and each simultaneously marked a new point of departure. In the early days a Show was held annually, but from 1922 onwards the interval was extended to two years, to allow time for the development of new prototypes.

All the Shows have been designed according to a new principle of a uniform style of decoration based on an overall plan. This principle of complete equality meets modern needs and has frequently been copied elsewhere.

André Granet, Architect in Chief to France's Civil Buildings and National Palaces Board, fails to mention in his article below that he must himself be described as the real "father of the Paris Shows". From 1909 to 1957 it is he who has been responsible for the organization of each succeeding exhibition. Granet's other offices include: Secretary General and co-founder of the Union Syndicale des Industries Aéronautiques (1908—1956); Secretary General of the Paris Air Show (1909—1957); Secretary General and co-founder of the Association Internationale des Constructeurs de Matériel Aéronautique. Editors

The idea of an international air show originated with the *Union Syndicale des Industries Aéronautiques,* which was founded in 1908, or more exactly with Robert Esnault Pelterie, one of France's most widely known inventors. The early Salons were modest affairs but increased in scope from year to year. As research expanded and the number of prototypes and production aircraft rose, the Union Syndicale kept pace in its rôle of coordinator. The principal committees worked increasingly at this task under the authority of the Association's succeeding presidents.

Today France's aircraft industry is engaged in keen international competition which it is endeavouring to direct into channels of European solidarity. Its principal instrument here is the *Association Internationale des Constructeurs de Matériel Aéronautique,* in the creation of which Sud-Aviation Chairman Georges Héreil and the late Pieter Vos, of Fokker, played so outstanding a part.

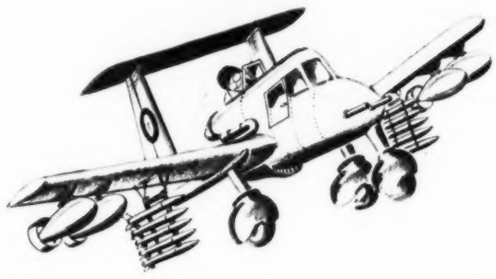
We are now about to enter on the third phase of aeronautical development, which will be marked by increasing use of jet power, the growth of increasingly large networks of air services, the application of electronics, the shattering of the sound barrier in commercial aviation and of the heat barrier in military, and the conquest of the stratosphere.

Following this irresistible drive, France's Association of Aircraft Manufacturers will gird itself for continued progress, and our international exhibitions will evolve in step to illustrate a "triumphant" aviation which may well take on forms as yet unsuspected.

With Pencil and Cognac Bottle at Le Bourget

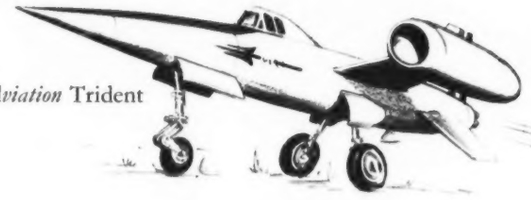
Call me Madam... Butterfly — Fouga CM.170R

Everything but the kitchen sink — Potez 75



Flying lock-jaw — Dassault Super Mystère

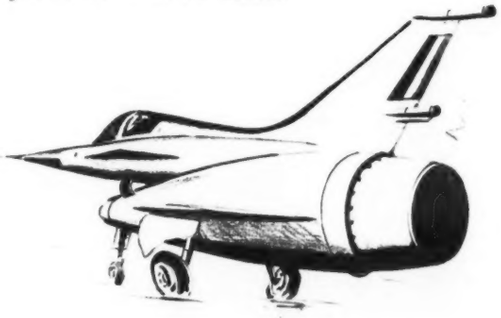
Small, but watch its sting — Sud-Aviation Trident



Following his nose — Leduc 022

Highly tempered but jet-propelled — Sud-Aviation Durandal

Pardon my afterburner! — Nord Griffon



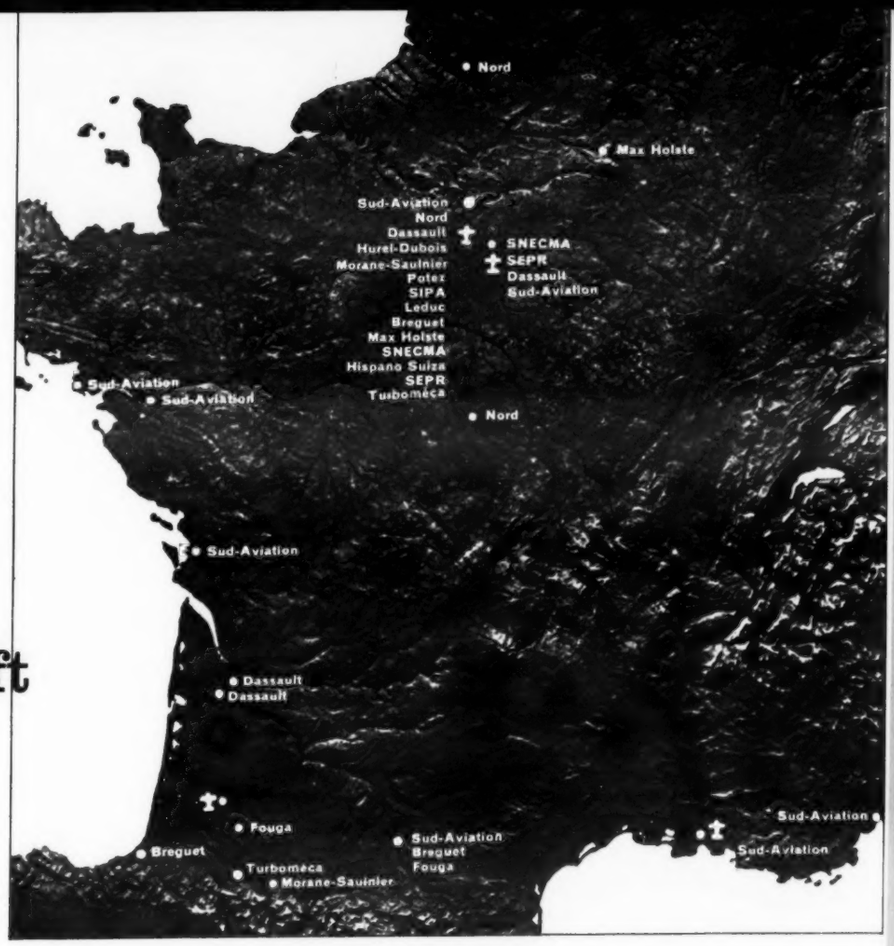
Back interest — Sud-Aviation Caravelle

Paris Preview

". . . Sur
les beaux chemins
de France"

Tour of the French Aircraft Industry

By Interavia Editor E. Baur



With the exception of the "vieille diligence" of the well-known French song we used every available means of transport to visit the major firms of the French aircraft industry, inspect their production plants and get to know their projects . . . insofar as they can be revealed to "outsiders". We used the Paris metro and buses and argued with unshaven short-tempered taxi drivers in order to get out to plants in the Paris outskirts. We entrusted ourselves to the new sleeping cars of the Compagnie Internationale des Wagons-Lits et des Grands Express Européens to reach the production centres in southern France. Finally a "demande de passage sur avion de transport militaire" sufficed to have placed at our disposal, for a brief trip to the Vosges, a Nord *Noralpha* which, after some hesitation, we piloted ourselves as best we could to our destination. Capitaine Prevot, the charming pilot, and his good-tempered "Juliette"—as his aircraft was called—both did their part to keep us from straying too far off course.

However, our assignment is not to describe personal experiences, much as we should like to, but to give a brief account of the industry's activities. To match the condensed nature of the trip, long-winded description will be avoided. Instead, we shall endeavour to show a series of living pictures, such as we ourselves were able to see.

*

Firstly, to clarify the present situation within the French aircraft industry, reference must be made to the most recent reorganizations, mergers, etc. The most important of these is without doubt the amalgamation on March 1st of the two biggest State-owned companies, Sud-Est Aviation and Ouest-Aviation (cf. *Interavia* No. 3, 1957), to form *Sud-Aviation,* which, with its some 21,500 employees, now ranks as the sixth largest aircraft manufacturer in the Western world. In the opinion of Sud-Aviation's President Georges Héreil, this merger marks a decisive step on the road to centralization of the French aircraft industry. It not only enables production programmes to be rationalized and coordinated but also proves the French industry's willingness to cooperate on a European level.

Other companies—for example Dassault—have undertaken reorganizations of a more internal nature during the past year or two, in order to concentrate their production resources and raise their output. Agreements on closer technical cooperation are also the order of the day (for example between Breguet and MATRA).

Thus, while retaining conditions of healthy competition—between State and privately-owned companies—the French aircraft industry has realized that it can retain and develop its position on the international market only if it makes the fullest possible use of its available resources, adapts its tooling to the requirements of modern aircraft production, systematically investigates the possible applications of new materials and refrains from reducing the efficiency of the design offices by duplications in development work.

Before passing on to the production programmes of the individual manufacturers, it may be well to give a few statistical details to indicate the size of the industry. According to figures supplied by the French Aircraft Manufacturers Association *(Union Syndicale des Industries Aéronautiques)*, there are today some dozen companies in the airframe industry (including missiles) employing more than 300 persons each. Totals in round figures are:

Airframe industry	
Sud-Aviation	21,500
SNCA du Nord	7,250
Dassault	5,000
Breguet	2,300
Morane-Saulnier	1,600
MATRA	700
SFERMA	660
Latécoère	610
Hurel-Dubois	500
Fouga	490
SIPA	390
Leduc	320
Engine industry	
SNECMA	10,000
Hispano Suiza	5,600
Turboméca	1,300
Société d'Etude de la Propulsion par Réaction	950
Potez	500

The following table of appropriations granted during recent financial years provides a certain measure of the French aircraft industry's increasing activity (figures represent millions of French francs):

	1953	1954	1955	1956	1957
Research and prototypes	25,749	26,100	33,200	35,510	43,900
Production	70,544	74,990	69,130	80,750	95,632
Spares	11,400	11,400	12,350	12,950	13,637
Total	107,693	112,490	114,680	129,210	153,169

Aeronautical exports have also been rising, from a total value of 2,100,000,000 French francs in 1952 to 4,200,000,000 francs in 1953, 5,900,000,000 francs in 1954 and 5,200,000,000 francs in 1955.

* * *

Airframe Production

The two State-owned companies, Sud-Aviation and SNCA du Nord, together employ roughly 30,000 persons, or approximately one-third of the total personnel engaged in the aircraft industry, the government organizations (such as ONERA) and the airlines. Their production is described below.

Sud-Aviation

Head Office: Paris.

Main plants: La Courneuve and Courbevoie, near Paris; Toulouse-Saint-Martin and Saint-Eloi; Marseilles-Marignane; Cannes; Saint-Nazaire; Nantes-Bouguenais and Rochefort.—Flight testing is carried out at the company's airfields and at the military bases of Melun-Villaroche and Istres.

Sud-Aviation's manufacturing and test installations near Paris are equipped primarily for development work and the construction of prototypes. For example, the *Courbevoie* plant is at present building a small experimental batch of SO.9050 *Trident II* interceptors (with SEPR rocket motor and two Turboméca *Gabizos*). Other activities include work on developments of the SO.4050 *Vautour* twin-jet multi-purpose aircraft (the *Vautour N* all-weather fighter, *Vautour A* low-level attack aircraft, *Vautour B* bomber). A prototype of the *Vautour's* successor—the SO. 4060 *Super Vautour* (probably with SNECMA *Atar 9* plus reheat)—is also being built. Special features of the SO.4060 are extremely high speeds and long range, probably A-bomb carrier capacity and relatively short take-off and landing distances. During our brief visit to Courbevoie, Manager Bentejac hinted at other projects (missiles?).

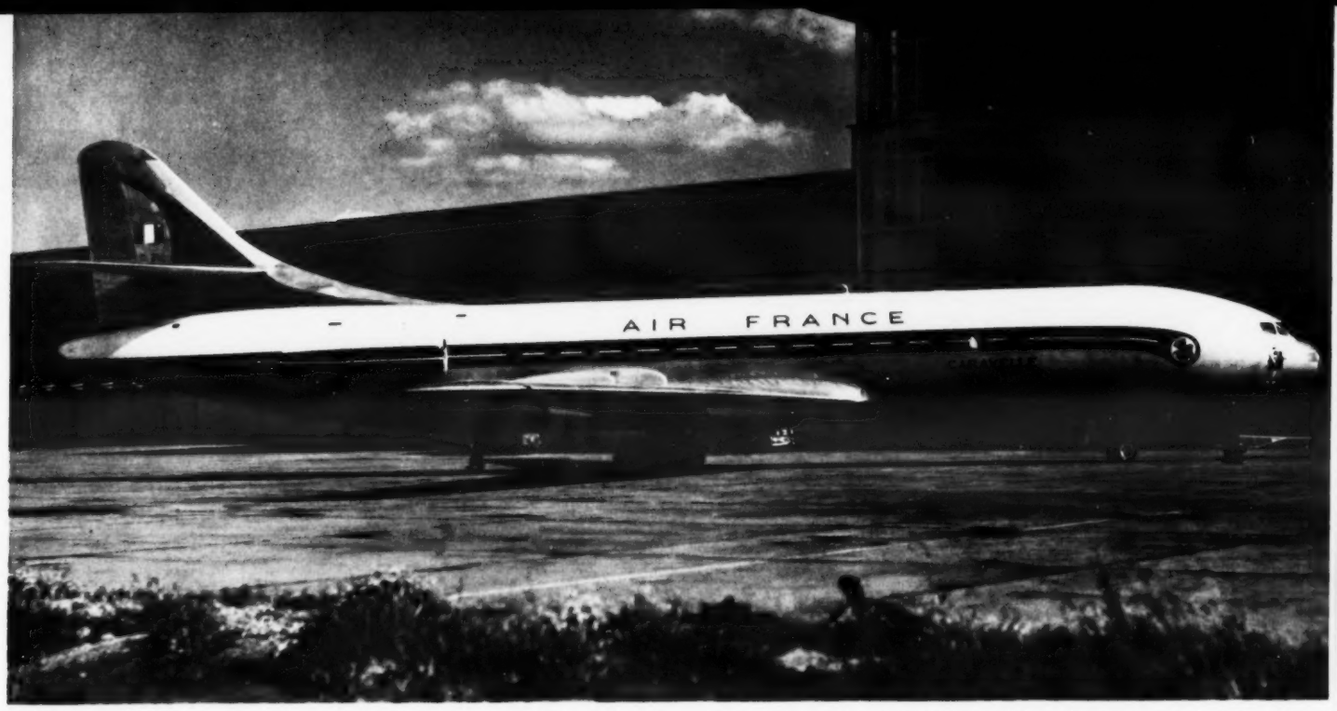
One outcome of the merger between Sud-Est Aviation and Ouest-Aviation is a plan to concentrate all rotary-wing manufacture at *La Courneuve*, under Engineer Ch. Marchetti. This includes production of the SE.3130 *Alouette II* and SO.1221 *Djinn*, and the development of new types. For experimental purposes an SE.3140 version of the *Alouette* with a more powerful Turboméca turbine has already been built, and work on two SE.3200 prototypes is now in progress. In all probability the *Djinn*, which set up a new world altitude record (8,482 m) for all classes of helicopter at Melun on March 22nd, 1957, will be developed into further versions.

At *Le Bourget* Sud-Aviation maintains a test centre for the *Alouette*. Some 200 of these helicopters have so far been ordered by French military and civilian authorities, and first foreign orders have also been received. A demonstration flight gave us convincing proof of the good climb performance (985 to 1,180 ft./min. in oblique climb, depending on load) and the practically vibrationless behaviour of this turbine-powered helicopter, whose simple controls make it well suited for pilot training.—It should finally be recorded that Sud-Aviation also produces the two American helicopters, Sikorsky S-55 and S-58, under licence (the S-58 is manufactured and assembled at Marignane).

Sud-Aviation's southern French plants

Toulouse and *Caravelle* are today inseparable names. The 01 prototype, having completed its endurance tests, is now undergoing a thorough overhaul of airframe, engines and equipment, while at the time of our visit the 02 prototype was being fitted out for its present demonstration tour of North and South America. The results of the operational testing

Sud-Aviation's SE.212 *Durandal* light-weight delta-wing interceptor; SNECMA-ATAR G reheat jet and SEPR 65 rocket motor. A second prototype of the *Durandal* is scheduled to begin flight testing before the Paris Show.



SE.210 *Caravelle* twin-jet medium-stage commercial transport. So far Sud-Aviation has received a firm order for 12 of these aircraft from Air France, who has also taken an option on another 13.

of the two prototypes were described in detail in *Interavia* No. 4, 1957. Meanwhile preparations for quantity production are going on apace. Air France, which has a firm order for twelve *Caravelles* and an option on another thirteen, is to receive the first three in 1958, another six in 1959, and the remaining three probably in 1960.

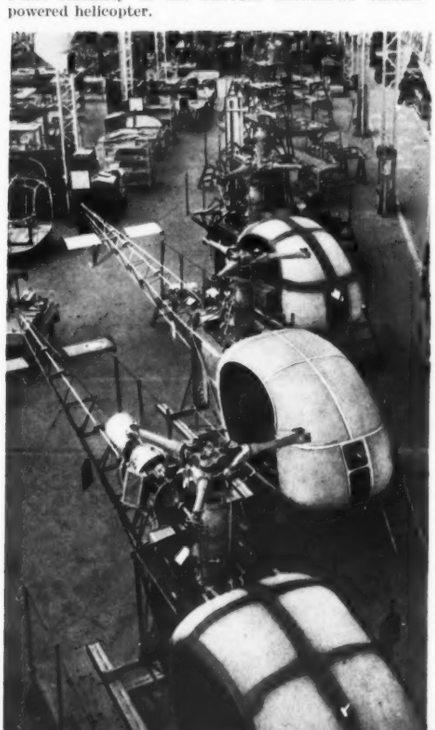
In a hangar set slightly apart from the rest of the Toulouse plant a group of specialists is working on the second prototype of the SE.212 *Durandal* light-weight delta-wing interceptor, which is scheduled to begin flight testing before the Paris Show. Few details have so far been released on this aircraft, which is powered by a SNECMA *Atar* 101G jet (with reheat) and an SEPR rocket motor. However, it is expected to have exceptional performance—a top speed of Mach 1.8 and a ceiling of well over 55,000 ft. are mentioned.

An interesting point is that the *Marseilles-Marignane* plant is working with renewed vigour on two SE.*Baroudeur* ground attack aircraft, which are to take part, as "outsiders", in the N.A.T.O. evaluation tests for light-weight tactical support aircraft (Fiat G.91, Breguet *Taon,* Dassault *Etendard VI*) arranged for June this year. Marignane, finally, is the birthplace of a new twin-engine type for infantry support, the SE.116 *Fonceur*. Designed primarily for operation overseas, the SE.116 is said to have a wide speed range and relatively heavy armament.

Sud-Aviation plants in Western France

While Toulouse and Marignane were the two main plants of the former Sud-Est Aviation, the merger with Ouest-Aviation brought the new company three efficient production centres in the west (Rochefort, Saint-Nazaire and Nantes Bouguenais). All three are equipped for quantity production. The main activity at *Rochefort* is production and flight testing of the SO.1221 *Djinn* light helicopter. *Nantes-Bouguenais* concentrates on the manufacture of wing units, with the present programme covering wings for the *Vautour, Caravelle* and *Mystère IVA*. Finally, *Saint-Nazaire* specializes in fuselages, and neighbouring Gron airfield is used for flight testing all types of aircraft. For example, the sky above Saint-Nazaire is seldom free of *Vautours*.

Final assembly of the SE.3130 *Alouette II* turbine-powered helicopter.



Roughly 200 *Alouette IIs* have so far been ordered by French civil and military authorities, and first orders have also been received from abroad.

SO.4050 *Vautour* twin-jet multi-purpose combat aircraft: below, the *Vautour II A* low-level attack version (single-seat); above, the *Vautour II N* all-weather fighter (two-seat).

SNCA du Nord

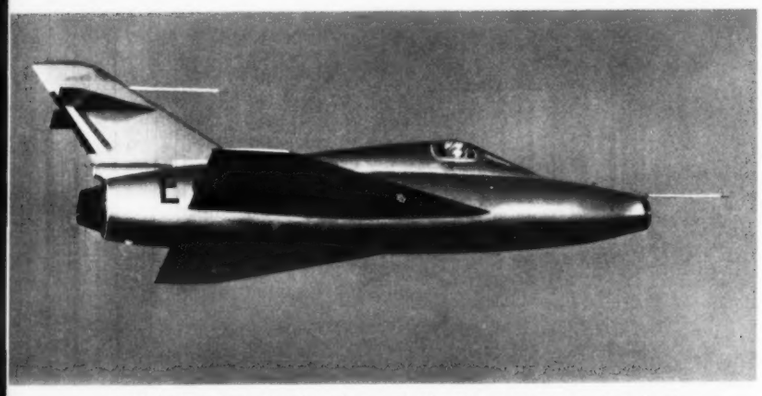
Head Office: Paris.

Plants: Châtillon-sous-Bagneux; Les Mureaux; Bourges; Méaulte. Also test beds and wind tunnel installations at Gâtines; airfields available for flight testing include Melun-Villaroche and Istres.

The heart and brain of SNCA du Nord are at *Châtillon,* where the administrative and design offices, the prototype plant and a development and manufacturing centre for guided missiles and remote-controlled target drones are situated. It is probably less well-known that Châtillon is also working intensively on special power plants (in particular ramjets). The missiles division has expanded considerably during the past few years, though few details can be given of its activities. One of its well-known products, however, is the CT.10 target drone (max. speed 245 knots; endurance roughly 35 minutes), which is also used by the Royal Navy. Sales negotiations for this equipment are in progress with

The SO.1221 *Djinn* light helicopter is also in quantity production. On March 22nd this year a *Djinn* reached an altitude of 8,482 m and thus set up a new world record for helicopters of all categories.

SO.9050 *Trident II* single-seat light-weight interceptor with SEPR rocket motor and two Turboméca *Gabizo* jets. A small experimental batch of the *Trident II* is being built.



Nord 1405 *Gerfaut II* light fighter with SNECMA-ATAR G jet plus afterburner.

The Nord *Griffon II* interceptor with turbo-ramjet powerplant has been flight testing since January 1957.

Japan, Italy, Canada, Holland and Sweden. The more powerful CT.20 drone (max. speed 485 knots; endurance 30 minutes) is being built in smaller numbers for France and will not be exported until at least the end of 1957. The cable-controlled SS.10 anti-tank missile is in production not only for the French forces but also for the United States, Sweden, Israel and Switzerland, and sales contracts are being discussed with at least a dozen other countries. The later model SS.11, which has roughly twice the range, is in production for the French Army.

SNCAN delta-wing designs

SNCA du Nord is doing pioneer work on delta-wing aircraft, four prototypes of which have been flight tested during the past three years: the Nord 1402 *Gerfaut I,* France's first high-performance aircraft of this configuration, began flight testing on January 15th, 1954, and exceeded Mach 1 in level flight for the first time on February 11th, 1955. An operational version, the Nord 1405 *Gerfaut II,* flew for the first time on April 17th, 1956, and recently set up five world records in climbing. Power is supplied by a SNECMA *Atar G* with afterburner.

In line with the specifications for a light interceptor, the aircraft of the *Gerfaut* series have very high climb and level speed performance, but can nevertheless be operated from unimproved bases and have relatively short take-off and landing distances. Another member of the light interceptor class is the *Griffon,* with delta wing and combination power plant (jet plus ramjet), the first prototype of which began flight testing on September 20th, 1955, and the second on January 23rd, 1957.

The Noratlas in production

The *Les Mureaux, Bourges* and *Méaulte* plants are organized entirely for large-scale production and all three are turning out the Nord *Noratlas* military and civil transport. Bourges is also manufacturing the NC.856 light artillery observation post for the French forces. Considerable plant expansions are planned at Bourges, where production of missiles is to begin shortly.

The qualities of the *Noratlas* and its considerable sales successes are already well known. They have moreover been confirmed on the one hand by the licence agreement concluded with Germany and on the other by the sales negotiations about to be completed with Finland, Venezuela and Brazil.

Chief Engineer Calvy, who is responsible for development of this aircraft, told us that the N.2501 version—the principal one now in production—by no means exhausts the development capacities of the *Noratlas* formula. There is already talk of a N.2506, into which the results of the N.2501's 80,000 hours of military operational experience are incorporated and which has a number of additional devices (variable-length main undercarriage to facilitate loading and unloading; cargo loading doors which can be operated from the pilot's seat, etc.), making it still more suitable for operations in the combat zone. The auxiliary jets (total thrust 1,760 lbs.) and the two groups of three JATO take-off rockets (total thrust 5,940 lbs.), which can be fitted if required, greatly cut down take-off distances. To reduce take-off and approach speeds as well as landing distance, the aircraft has been equipped with more efficient landing flaps. Both airframe and undercarriage have been strengthened to permit operation from practically any kind of terrain. For employment as an assault transport (gross weight 45,300 lbs.) the N.2506 can take off in a runway length of less than 2,000 ft.; take-off run is 1,150 ft.; take-off speed is roughly 80 knots. Landing distance from 50 ft. is 1,560 ft., and landing run 740 ft.—Two other, less-known versions of the *Noratlas* should also be mentioned briefly: N.2507 (under development and destined for sea rescue duties; with *Marboré* auxiliary engines) and N.2508 (with Pratt & Whitney engines plus two *Marborés*).

(Continued on p. 405)

An A.B.C. of the French Accessories and Equipment Industry

A.B.G., Aries, La Bougie B.G. & Sfeder Réunies (Paris & Courbevoie): Ignition systems for turbojets; magnetos; spark plugs; ignition cables; inspection and test equipment; fire-detection systems; fittings.

Aciérie des Ancizes, Aubert & Duval (Neuilly-sur-Seine): Special steels for aircraft and engine manufacture.

A.D.R., Applications du Roulement (Paris): Ball and roller bearings for control systems, gyroscopes, generators, etc.

Aérazur, Constructions Aéronautiques (Paris): Life jackets, rubber dinghies; parachutes of all kinds; G-suits; auxiliary vehicles for aviation use.

Aérocessoires Simmonds (Levallois-Perret): "Nylstop" and "H.T." safety nuts; electronic measuring equipment.

Air-Equipement S. A. (Asnières): Communications and electronic equipment, including homing D/F receivers; aircraft intercom. systems with transistors; radio compasses; aircraft electrical equipment of all kinds; field stations for ground-to-ground and air-to-ground R/T and W/T communications; voltage regulators; ignition systems for turbine engines; starters for jet and piston engines; pressure gauges for lubricant and hydraulic systems; aircraft medicinal oxygen systems, etc.; shock absorbers and hydraulic jacks for undercarriages.

Airindex, Etablissements (Courbevoie): Engine control and supervision equipment.

A.M.A., Etablissements (Levallois-Perret): Engine controls; lubricant, coolant and fuel systems; filters.

Andyar, Société pour l'Exploitation des Procédés et Brevets H. André & M. Yardney (Neuilly-sur-Seine): Light-weight silver-zinc accumulators with low acid content, used for starting high-power turbojets.

Auxilec, Auxiliaires Electromagnétiques de Précision (Colombes): Aircraft electronic equipment; electro-motors; transformer groups, etc., starters for jet engines.

Aviac, Etablissements (Courbevoie): Electrical and mechanical remote controls, etc.

Avialex, Société (Chatou): Burners for de-icing and air-conditioning systems; test beds for jet engines; sheet metal work.

Barbier, Benard & Turenne (Paris): Airport lighting installations; signal flares; optical equipment; aircraft instruments.

Bergougnan, Société Générale des Etablissements (Clermont-Ferrand): Aircraft tyres.

A. Boet & Cie (Ascq.): Airport silencers for jet engines and aircraft; sound-proofing of test beds for jet and piston engines.

Le Bozec et Gautier (Courbevoie): Engine accessories (in particular equipment for SNECMA-ATAR jet engines); filters, etc.

Breguet, S. A. des Ateliers d'Aviation Louis (Paris): Precision time markers for aeronautical and marine use.

Brion, Leroux & Cie (Paris): Electrical measuring instruments; switches; warning lights.

Bronzavia S. A. (Courbevoie): Engine accessories (carburetters, injection pumps, fuel pumps); electric motors; voltage converters; aircraft equipment (telephone, reflex and gyro sights, camera guns, bomb sights); radio equipment; VHF transmitter-receivers; sheet metal parts for aviation uses; pressurizing and air-conditioning systems.

Le Bronze Industriel, René Loiseau & Cie (Bobigny): Bronzes and special copper alloys; nickel and nickel alloys.

Carel Fouché & Cie (Paris): Structural materials, in particular light metal alloys.

Cégédur, Compagnie Générale du Duralumin et du Cuivre (Paris): Semi-manufactured parts of non-ferrous metals and high-resistance light metals; heavy metal working; sheet metals and sections; special alloys for forged and stamped parts.

Cellolac S. A., Etablissements (Croissy-sur-Seine): Paints and varnishes; protective coatings.

Champion, Société de Construction de Machines Electriques et Pneumatiques (Paris): Machine tools and accessories.

Chausson, S. A. des Usines (Asnières): Oil and water coolers; heat exchangers; temperature regulators; heating equipment; fuel tanks.

C.I.M.A., Cie Industrielle de Matériel d'Aviation (Courbevoie): Flexible hose; protective covers for fuel tanks; flexible fuel tanks.

Crouzet Aviation (Paris): Intervalometers; totalizers for dead reckoning navigation; parachute release systems; delay systems for ejection seats.

Crozier S. A., Etablissements (La Garenne): Air-conditioned containers.

CSF/SFR, Compagnie Générale de Télégraphie sans Fil/Société Française Radioélectrique (Paris): Communications and electronics systems (cf. elsewhere in this issue); in particular surveillance radar; airborne radar for storm and collision warning; radio altimeters; electronic computers; instrument landing systems, etc.

Dassault, Générale Aéronautique Marcel (Paris): Afterburners for jet engines; electronics.

Delord, Société Industrielle M. et A. (Paris): Electrical and mechanical engine supervision instruments.

Derveaux, Laboratoires (Boulogne/Seine): Telecommunications and electronics (VHF and UHF transmitter-receivers; radar equipment; airborne and ground aerial systems; remote controls; spiral television for reconnaissance and airspace surveillance; electronic sights, etc.); cf. elsewhere in this issue.

D.O.P., Dispositifs Oléo-Pneumatiques (Boulogne/Seine): Undercarriages and undercarriage parts; wheel brakes; hydraulic aircraft equipment.

Dunlop, S. A. des Pneumatiques (Paris): Tyres; wheel brakes; brake pressure regulators; "Maxaret" anti-skid system; equipment for thermal de-icing; fibreglass containers impregnated with artificial resin, for compressed air, etc.

E.C.A., Etudes et Constructions Aéronautiques (Bellevue & Asnières): Autopilots; sights; stabilizing and rate gyros; electrical controls; regulating systems; servo motors and servo controls; electrical controls for guided missiles.

E.C.E., L'Equipement et la Construction Electrique (Paris): Current pick-ups; electrical indicators; amplifiers; signal systems; servo and remote controls.

E.F.A., Etudes et Fabrications Aéronautiques (Clichy/Seine:) Parachutes for personnel and cargo; anti-G suits; belts and harnesses.

E.R.S., Etablissements (Paris): Magnetic stoppers for accumulators.

E.S.P.A., Equipements Spéciaux pour l'Aviation (Montreuil): Flexible hose; hose joints; light-weight tubing; air-conditioning plant.

E.T.N., Etudes et Techniques Nouvelles (Paris): Access rigs; hoisting tackle; winches; lifting trolleys; cranes.

E.U.C., Société d'Electro-Chimie, d'Electro-Métallurgie et des Aciéries Electriques d'Ugine (Paris): Special steels for aircraft production.

Faure Herman, Etablissements (Boulogne/Seine): Fuel metering equipment with electronic control for turbine and piston engines; electrical rev. speed indicators; measuring instruments for rate of fuel consumption; special equipment for test beds.

Fenwick S. A., (Paris): Tools and machine tools; "Titeflex" flexible metal hose; hoisting equipment.

Fermeture Eclair—Division Marston (Rouen): "Flexelite" flexible fuel tanks; laminated plastics for radomes, antenna housings; light-metal alloys.

Filotex, Etablissements (Draveil): Wires for cables (power cables and radio); coaxial cables; protective casings and copper braiding; multiple cables; compensation cables.

Fonderies de Méru (Paris): Inspection covers for gas and water pipes, etc.

H.B., Etablissements (Issy-les-Moulineaux): Hydraulic hose for very high pressures and temperatures; flexible hose.

Hélices Ratier (Montrouge): Regulators, remote controls, etc.

Hispano Suiza S. A., Société d'Exploitation des Matériels (Bois-Colombes): Undercarriages (SO.4050, SE.210, Breguet 1050, etc.); cast parts and aluminium castings; tropical, dehydrated metal containers for the storage of aircraft guns.

Intertechnique (Boulogne-Billancourt): Current converters; fuel pumps and residue indicators; oxygen regulators; electronics.

Jacottet S. A., Etablissements Paul (Versailles): Remote controls, in particular power-boosted controls (irreversible and with hydraulic feel simulators).

Jaeger, S. A. des Etablissements Ed. (Levallois-Perret): Mechanical and electrical airborne instruments of all types.

Kléber-Colombes (Paris): Tubeless tyres; pneumatic de-icers for wing and tail leading edges and propellers; flexible, Klégécell and Klémocell ultra-light cellulose plastics; production of Goodyear's "Altitherm" heating coating.

K.L.G. S. A. (Paris): Spark plugs and igniters.

Labinal, Etablissements (St. Ouen/Paris): D.C. and A.C. generators; starting equipment; regulators; switches; prefabricated equipment components; Jack & Heintz agency for machines, motors and apparatus; Hartman Electrical Co.—equipment production.

L.M.T., Le Matériel Téléphonique (Boulogne-Billancourt): Telecommunications and electronics, including radio equipment of all kinds; electronic instrument flight trainer; remote control equipment.

Loire-Normandie, Société des Chantiers Réunies (Paris): Machine tools, in particular deep drawing and stretch presses of very high power; pumps; accumulators.

Magnésium, Société Générale du (Paris): Ultra-light magnesium alloys.

Magnétos R.B., Société des (Paris): Magnetos and ignition coils; test equipment.

M.A.T.R.A., Société Générale de Mécanique—Aviation—Traction (Boulogne-Billancourt): Design and construction of special aircraft; guided missiles; rocket launching ramps; aircraft armament; autopilots, etc.

Messier, Société (Montrouge): Design and manufacture of undercarriages of all sizes; hydraulic and electro-hydraulic control systems for aircraft use; wheels and wheel brakes and their hydraulic control systems; " Ministop " brake pressure regulator; high-pressure pumps; test beds; electronics.

Microfiltres A.E.F. (Courbevoie): Microfilters for ground and aircraft systems; equipment for handling and cleaning fluids.

O.M.E.R.A., Société d'Optique, de Mécanique, d'Electricité et de Radio (Argenteuil): Electronic, optical and precision mechanical equipment; VHF and UHF equipment; radar equipment (Decca licence); radio beacons (AGA licence); optical equipment for aerial reconnaissance, SEPHOT licence.

Paris-Rhône, Société de Paris & du Rhône (Paris): Airborne generators; plastics; castings, etc.

Pékly, Société (Paris): Electrical measuring instruments, etc.

Potez, Etablissements Henry (Paris): Portable and jettisonable generator groups.

Précilec S. A. (Paris): Small electric motors, in particular for servo controls; remote-reading indicators, etc.

Produits Chimiques du Moulin (Lutterbach): " Divolic " bonding fluid; " Divopat " bonding paste for sealing, insulation, bonding.

Radio-Air, S. A. des Applications Industrielles Radioélectriques (Neuilly-sur-Seine): Airborne transmitters and receivers; radio compasses; magnetic tape recorders; intercommunication systems ; radio signalling beacons.

Radio-Industrie, Société Nouvelle de l'Outillage RBV et de la Radio-Industrie (Paris): Telecommunications and electronics (e.g., VHF systems; electronic computers; special tubes; television equipment); three-dimensional radar equipment for 10-cm waves.

Ragonot, Etablissements E. (Malakoff/Seine): Electric motors; generators; transformers, etc.; remote-reading indicators.

Rellumit, Etablissements Muller (La Garenne-Colombes): Fuel and lubricant filters; flexible hose; tube connections; rapid fuelling systems; fixed and mobile fuelling systems.

Rochet Jean (Asnières): Special lamps for signalling purposes.

Rubanox (Neuilly/Seine): Radiators, exhaust gas manifolds; jet pipes for turbine engines; sheet metal parts.

Sadir-Carpentier S. A. (Paris): Radio and radar equipment; fire control systems; electric motors and electrical measuring equipment.

S.A.F.T., Société des Accumulateurs Fixes et de Traction (Romainville): " Voltabloc " no-maintenance aircraft batteries.

S.A.M.M., Société d'Applications des Machines Motrices (Billancourt): Equipment for high-pressure hydraulic systems; servo controls; ground equipment for air combat training; hydraulic pumps; wheel brakes and shock absorbers; electronics.

S.A.R.A.M., Société d'Applications Radioélectriques à l'Aéronautique et la Marine (Asnières): VHF and UHF transmitter-receivers for aircraft and ground use, etc.

S.A.R.M.A., S. A. de Recherches de Mécanique Appliquée (St. Vallier-sur-Rhône): Aircraft control systems, pilot seats with sprung belts (Pacific Scientific Co. licence).

S.A.T.A.M., S. A. pour Tous Appareillages Mécaniques (La Courneuve): Equipment for fuel trucks; airport equipment of all kinds (pressure fuelling equipment, hose joints, counters).

Sciaky S. A. (Paris): Welding machines; electronic control systems.

Scintex S. A., (Courbevoie): Variable pitch constant speed propellers for low-power engines; magnetos; electronic equipment for firing sequence control.

S.E.A., Société d'Electrique et d'Automatisme (Courbevoie): Analogue computers and simulators.

S.E.C.A.N., Société d'Etudes et de Constructions Aéro-Navales (Gennevilliers): Jettisonable auxiliary tanks; jet pipes for turbine engines.

S.E.M.C.A., Ateliers (Toulouse-Aucamville): Air-conditioning plant; fuel feed systems (turbine pumps, auxiliary turbine motors); starters for jet engines; valves; ultra-light connectors for low-pressure air, kerosene, nitric acid hose, etc.

S.E.P.R., Société d'Etude de la Propulsion par Réaction (Paris): Rocket motors for solid and liquid propellants and associated accessories.

S.F.E.N.A., Société Française d'Equipements pour la Navigation Aérienne (Neuilly/Seine): Gyroscopes and magnetic compasses; complete navigation equipment; autopilots and controls for guided missiles; transmitters and receivers; light-weight yaw dampers to stabilize target approach at very high speeds.

S.F.I.M., Société de Fabrication d'Instruments de Mesure (Massy): Aircraft instruments; oxygen regulators; gyroscopic and magnetic compasses; radio compasses; gyro horizons; test instruments for inspecting special aircraft and guided missiles.

S.F.O.M., Société Française d'Optique et de Mécanique (Rueil-Malmaison): Aerial cameras; sights and navigation instruments; photographic accessories.

S.G.E., Société Générale d'Equipements (Puteaux): Aircraft electrical equipment of all kinds (Lear licence); test equipment; afterburners for jet engines and thrust reversal devices.

S.I.N.T.R.A., Société Industrielle des Nouvelles Techniques Radioélectriques (Asnières): Training equipment for radar controllers and radar test equipment.

S.N.C.A. du Nord (Villeurbanne plant): Manufacture of machine tools, including " Jaboréva " flanging and shaping machines.

S.N.F.A., Société Nouvelle de Fabrications Aéronautiques (Paris): Precision ball bearings for the aircraft industry.

Socapex-Ponsot, Etablissements (Suresnes): Microphones; headphones; parts for radio equipment.

Sofrance S. A. (Limoges): Gasoline and kerosene filters for all purposes; water separators.

Souriau & Cie, S. A. (Billancourt): Weather-tight plugs and switches.

Sud-Aviation (Paris): Fully automatic ejection seats; plastic honeycomb materials; metal bonding process.

Superflexit S. A. (Bois-Colombes): Flexible fuel tanks; flexible hose.

Técalémit S. A. (Paris): Cabin cooling and heating systems; fuel and lubricant distributors; flexible hose; production and sale of " Aeroquip " products.

Téléflex, Dept. de Tiss-Métal Lionel-Dupont & Cie (Ivry-sur-Seine): Mechanically power-boosted aircraft controls.

Textiglass—Pierre Genin & Cie., S. A. (Paris): Sale of " Textiglass " plastic with glass fibre reinforcement; plastic insulation material.

Thomson-Houston, Compagnie Française (Paris): Telecommunications and electronics (cf. elsewhere in this issue); production of T.P.C. radar fire control systems for target acquisition for medium anti-aircraft guns; radio communications equipment; radar equipment for traffic control, airspace surveillance and precision approach; training equipment for GCA controllers; gas discharge tubes, etc.; radio tubes for highest frequencies; transportable transmitter-receivers.

Triplex, Société du Verre (Longjumeau): Safety glass and armoured glass; filter glass, etc.

T.R.T., Télécommunications Radioélectriques et Téléphoniques (Paris): Mobile HF transmitter stations; HF, VHF, UHF radio equipment; directional beam radio links for telephony and television; airport equipment.

Turck, Etablissements Jean (Cachan): Remote-control and telemetering systems; radio command controls; data transmission systems; detectors and transmitters for infrared rays; thermo-elements and photocells.

Vibrochoc, Société (Paris): Shock-absorber mountings of all kinds (Robinson Aviation licence).

Zénith S. A., Société du Carburateur (Levallois-Perret): Equipment for fuelling, circuits, fuel feed; Hobson-Flight Refuelling, Plessey-Saunders Valve licences; pressure ventilation systems for fuel tanks; carburetters; filters; pumps.

Nord 2501 *Norallas* (SNECMA *Hercules* engines), as used by the French Air Force for the transport of troops and supplies.

Générale Aéronautique Marcel Dassault

Head Office: Saint-Cloud, near Paris.

Plants: Saint-Cloud; Argenteuil; Boulogne-Billancourt; Bordeaux-Mérignac; Talence.—Flight testing is done at Melun-Villaroche, Bordeaux-Mérignac and the Government flight test centres.

Générale Aéronautique Marcel Dassault continues to occupy a leading position in the manufacture of fighters and ground attack aircraft, and there can be no doubt that the future of its latest products, the *Etendard* and the *Mirage,* is assured.

A tour of the Saint-Cloud development plant, where the design offices are also situated, reveals that substantial investments have been made in new machine tools, which will pay off in reduced man-hours; new manufacturing methods (chemical milling, for example) and new materials (e. g., plastics, titanium, etc.) are constantly being tried out. To cut down the time required for developing new prototypes and above all to become independent of delivery dates for engines, Dassault has also gone into production with low and medium power jets (*Viper* under licence; this engine was later developed into the MD.30 *Viper* with reheat, giving a total thrust of roughly 2,200 lbs.). Today a new jet engine is announced, the R.7 of 3,080 lbs. thrust, which is to be shown in Paris; it may possibly also be used in guided missiles and target drones. Finally, Saint-Cloud produces all the servo controls for Dassault's high-performance fighters. It will scarcely come as a surprise that Dassault has formed an electronics division at the Argenteuil plant, whose growing importance suggests that the company will soon begin building missiles of its own design. Otherwise Argenteuil, like Boulogne-Billancourt and Talence, is equipped for quantity production, at the moment of the *Mystère IVA* and *Super Mystère* fighters. Final assembly is done at Mérignac.

The aircraft of the *Etendard* and *Mirage* series can compete as regards performance with the latest American types in their class. A *Mirage III* delta-wing interceptor recently exceeded Mach 1.5 in level flight—with full combat load—and the makers plan to develop it for top speeds equivalent to Mach 2 (SNECMA-*Atar 9* of approx. 13,200 lbs. thrust).

Incidentally, during our visit to Saint-Cloud we were able to spot, from a respectable distance, the outlines of a "what might that be?" Was it the extremely high speed *Mirage IV,* of which there has been frequent mention recently?

S.A. des Ateliers d'Aviation Louis Breguet

Head Office: Paris.

Plants: Vélizy-Villacoublay; Toulouse-Montaudran; Anglet and Biarritz-Parme.—The military test centres are also available to Breguet for flight testing, etc.

Having completed a commercial consolidation, Breguet is setting about an energetic expansion programme. Plant is to be enlarged, additional machine tools purchased and labour force increased by some 1,000 men during the next two years. It is also planned to turn Vélizy-Villacoublay primarily into a research and development centre, with the

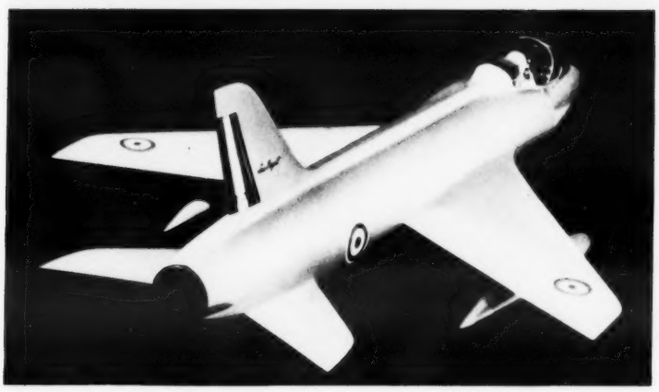
On the Up and Up...

Nobody sitting opposite André Turcat in the small *bistrot* at Châtillon and watching him genially munching one almond slice after the other, carefully weighing his words and darting an occasional sly glance from the corner of his merry eyes, would ever come upon the idea that here was the holder of four world records for rate of climb.

Yet Turcat, works test pilot at SNCA du Nord, flying a Nord *Gerfaut II* light-weight interceptor on February 16th, 1957, incontestably bettered four records held since 1951 by Britain (with a *Sapphire-Meteor*), climbing to 6,000 m (approx. 19,680 ft.) in 1 min. 17 secs., to 9,000 m (29,520 ft.) in 1 min. 34 secs., to 12,000 m (39,360 ft.) in 2 mins. 18 secs., and to 15,000 m (49,200 ft.) in 3 mins. 35 secs. Barely two weeks later, France secured another world record in this class, when Michel Chalard, a colleague of Turcat's, climbed to 3,000 m (9,840 ft.) in 51 seconds, again in the *Gerfaut II*.

André Turcat regards these records as particularly significant since they were set up not by an experimental aircraft specially designed for the purpose, but by an operational type. After all, a very high rate of climb is one of the essential requirements for any interceptor . . . and SNCA du Nord certainly appears to have scored a bull's eye with its *Gerfaut II*.

Nord 2506 *Norallas* with two Turboméca *Marboré II* auxiliary jets at the wing tips. The Nord 2506, in the design of which the results of the Nord 2501's 80,000 hours of military operational experience have been incorporated, is scheduled to replace the 2501 with the French Air Force.



Breguet 1001 *Taon* light-weight ground attack aircraft with Bristol *Orpheus* jet.

plants in the Southwest taking over quantity manufacture and assembly. Plans for the Toulouse area call for an enlargement of the Blagnac plant.

Breguet's varied work programme covers manufacture of everything from military and civil transports—the *Deux-Ponts*—to gliders.

There is no need at this stage to introduce readers to the *Deux-Ponts*. A later development, the Br.765, has recently been ordered for the French Air Force, and it may be assumed that the present contract for fifteen aircraft will be increased.

The two light-weight ground attack aircraft, Breguet 1001 *Taon* (N.A.T.O. programme) and Breguet 1100 (French Air Staff programme) are both entries in the contest for the projected European standard type for ground support (and if necessary aerial combat). The Breguet 1050 *Alizé*, with a 1,900 h.p. Rolls-Royce *Dart 7* turboprop, is in production for the French Naval Air Arm, and work is going ahead on the Breguet 940 *Intégral* STOL aircraft (four 400 h.p. Turboméca *Turmo 2* turboprops).

Three-seat Breguet 1050 *Alizé* anti-submarine aircraft with Rolls-Royce *Dart 7*, in production for the French Naval Air Arm.

*

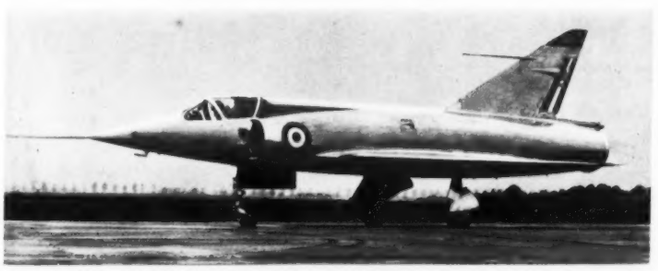
Before passing on to the engine manufacturers' production programmes, brief reference must be made to seven smaller, but very active, airframe companies: *Avions Hurel-Dubois*, with plant at Meudon-Villacoublay; *Air Fouga*, with head office in Paris and production shops at Toulouse, Aire-sur-Adour and Béziers; *Morane-Saulnier* at Puteaux, near Paris, and Ossun-Louey, near Tarbes; *Etablissement Henry Potez*, with head office in Paris and works at Suresnes and Argenteuil; *Avions Max Holste*, with head office in Paris and plant at Reims; *Société Industrielle pour l'Aéronautique* (SIPA) at Suresnes; *René Leduc*, with offices and works at Argenteuil.

Dassault *Etendard IV* ground attack aircraft with SNECMA-ATAR E.

Hurel-Dubois is continuing operational testing of the HD.321 (high aspect ratio wing), and the first of eight HD.34s ordered for the *Institut Géographique National*, with special equipment for air survey work, began flight testing on February 26th, 1957. The British firm of F.G.Miles is also working on several cargo aircraft with wings designed on Hurel-Dubois principles.

Fouga has been highly successful with the CM.170-R *Magister* twin-jet trainer. Not only Germany (where the aircraft is to be built under licence in substantial numbers), but also a number of other European and Middle East countries have opened negotiations for either purchase of the *Magister* or its production under licence. Finally, Grumman Aircraft Engineering Corporation has taken an option to build the CM.170-R and CM.175 in the United States.

Developments of the *Magister* (for example, the CM.175 naval version and an experimental version with modified wing) are under study, and a four-seat observation aircraft, the CM.232, is being built for the French Army.



Dassault *Mirage III* light-weight fighter with SNECMA-ATAR G plus reheat.

Eight Hurel-Dubois HD.34s with special equipment are to be supplied to the *Institut Géographique National*.

In addition to Germany, where the Fouga CM.170-R *Magister* is to be built under licence in substantial numbers, several other European and Middle East countries have opened negotiations for the purchase or licence production of this trainer.

Fouga CM.171 *Makalu*, a development of the *Magister* designed as a flying test bed for the Turboméca *Gabizo* jet.

Avions Max Holste has orders on its books for more than 300 of its MH.1521 *Broussard* small transport and multi-purpose aircraft.

Morane-Saulnier MS.760 *Paris* twin-jet communications and touring aircraft.

Morane-Saulnier has received its first export order for the MS.760 *Paris* twin-jet communications aircraft: Argentina has bought components for 48, which will be assembled at the I.A.M.E. plant at Córdoba. In addition a substantial number of MS.760s is in production for the French Air Force and Naval Air Arm, and demonstration flights were recently made to representatives of the Belgian civil and military authorities. The Belgian Air Force is interested in the aircraft, as it plans to adopt all-through jet training for its pilots. Sabena, too, is said to be considering it for conversion training purposes.—The latest Morane design is the MS.1500 two-seat light communications and multi-purpose turboprop aircraft.

Potez last year obtained a production contract for 115 Potez 75 ground attack and anti-tank aircraft, as a result of intensive operational testing in North Africa. This aircraft is designed for the Army and will normally be armed with four 7.5-mm machine guns and eight rockets, though it can also use Nord SS.11 missiles.

Max Holste holds orders for more than 300 MH.1521 *Broussard* single-engine transport and multi-purpose aircraft for civil and military use (for example, ten are to go to Argentina). Development of a twin-engine passenger and cargo model, the MH.250 *Super Broussard,* is planned.

In mid-1956 *SIPA* received a development contract from the *Service Technique de l'Aéronautique* for a twin-engine police aircraft, the SIPA 1100. This type is designed especially for operation in the French Union and is suitable for the most varied combat missions.

Leduc is continuing intensive tests with the Leduc 022 research aircraft, which made its first flight on December 26th, 1956. Thirty flights have already been made on the jet alone (SNECMA-*Atar E*), and tests with the ramjet are expected to start before the Paris Show.

Engine Manufacturers

More than half the labour force of the French aircraft engine industry is employed by the State-owned Société Nationale d'Etude et de Construction de Moteurs d'Aviation, whose ATAR series of turbojets has no

Potez 75 two-seat anti-tank aircraft, in production for the French Army.

At Melun-Villaroche, roughly 26 miles south of Paris, SNECMA maintains this test centre with the most modern equipment: 15 test beds for complete jet engines, three test beds for turbine engines in the vertical position, two compressor test stands and 15 test beds for combustion chambers are only some of the installations available.

SNECMA uses quite a sizable fleet of aircraft for flight testing its engines. In the foreground a *Mystère II* with SNECMA thrust reverser; behind, the SE. 2060 *Atar-Armagnac*.

Simultaneous testing of four SEPR rocket motors at Melun-Villaroche.

rivals in Continental Europe. The second largest engine manufacturers are Hispano Suiza, a company which originally joined the ranks of jet producers by acquiring licences for the Rolls-Royce *Nene, Tay* and *Avon*.

SNECMA

Head Office: Paris.

Plant: Paris; Gennevilliers; Suresnes; Billancourt.—Test centre Melun-Villaroche.

SNECMA's main products are the axial-compressor turbojets of the *Atar* series, technical details of which were given in Interavia No. 4, 1956. Since that time, however, the *Atar D* has progressively been replaced on the production line by the *Atar E,* which powers the production SO.4050 *Vautour,* as well as the MD. *Etendard IV,* SE.5003 *Baroudeur,* Nord *Griffon* and Leduc 022. A cut-away model of the *Atar E* will be on view on SNECMA's stand at Paris.

At the same time as the *Atar E,* its variant *Atar G* (with afterburner) also went into production, for installation in the *Super Mystère B.2,* SE.212 *Durandal,* Nord *Gerfaut* and MD. *Mirage III.*

The latest versions of the *Atar* are the *Atar 8* (9,680 lbs. s.t.) for the Air Force and Navy version of the *Etendard IV* and a successor to the *Vautour;* the *Atar 9,* which delivers 13,200 lbs. of thrust with reheat and is destined for a later version of the *Durandal* and other prototypes still under development. Both *Atar 8* and *Atar 9* are being built in pre-production batches, and one of the latter is scheduled to be shown in public for the first time in Paris.

Pioneer work is also being done in the field of vertical take-off. SNECMA has systematically developed a version of the *Atar* suitable for operation in the vertical position. This is used in the "Flying Atar", three models of which have been built: the C-400 P-1 (remote-controlled), the C-400 P-2 (with pilot's seat mounted rigidly above the air intake) and C-400 P-3 (with fully equipped cabin and swivelling pilot's seat). The "Flying Atar" project is by no means a mere experiment, but is designed to lead to the future production of operational aircraft. At any rate, SNECMA engineers' goal is to provide the airframe industry with a jet engine, complete with control and stabilization system, which could be fitted in VTOL aircraft of any configuration (for example, coleopters).

Hispano Suiza

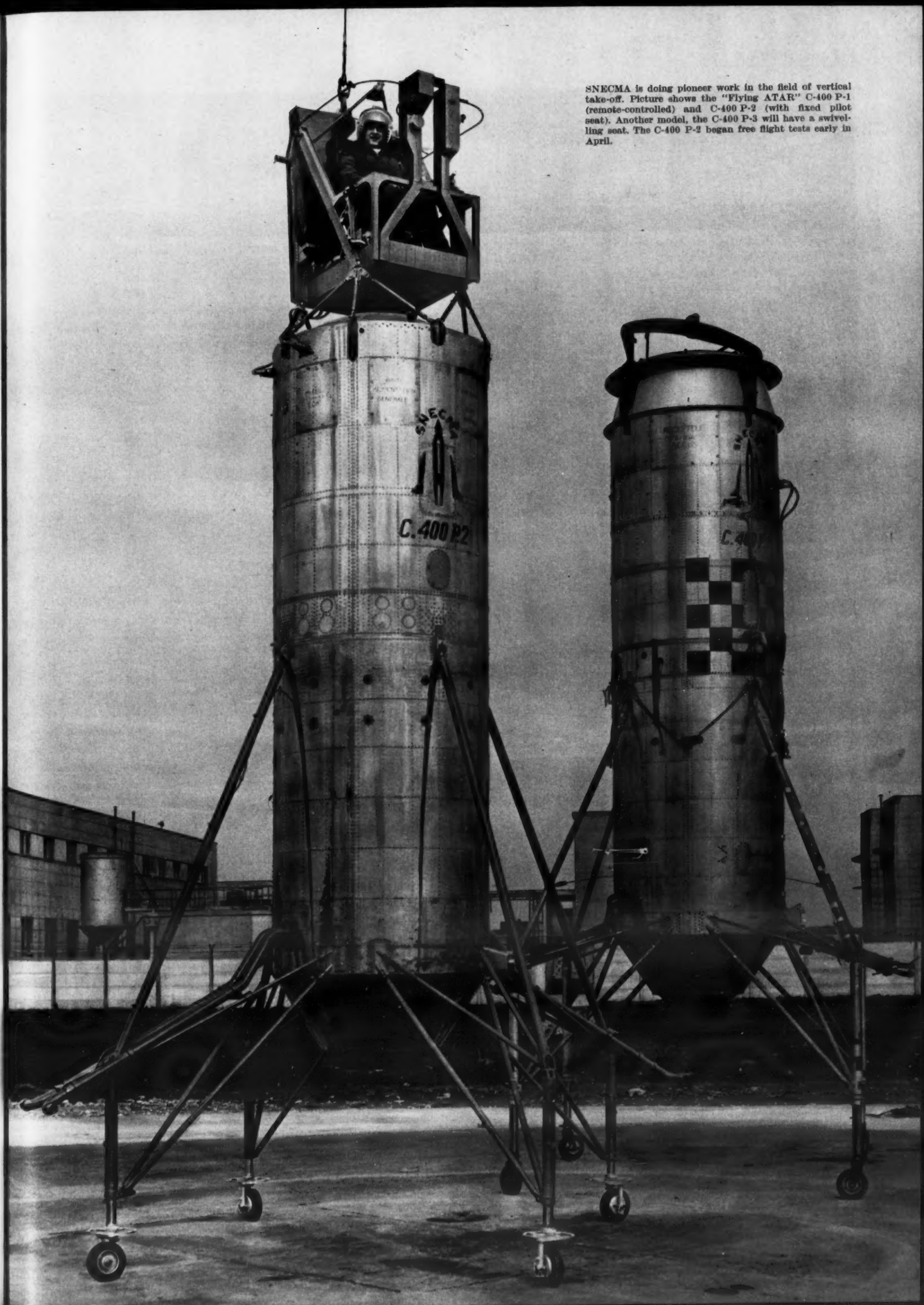
Head Office and plant: Bois-Colombes.

Considerable interest was aroused in April 1956 when Hispano Suiza and Turboméca signed an agreement on closer technical cooperation in all branches of gas turbine research and development. A new company—Compagnie Générale des Turbo-Machines CGTM—was set up by the two firms to handle this programme.

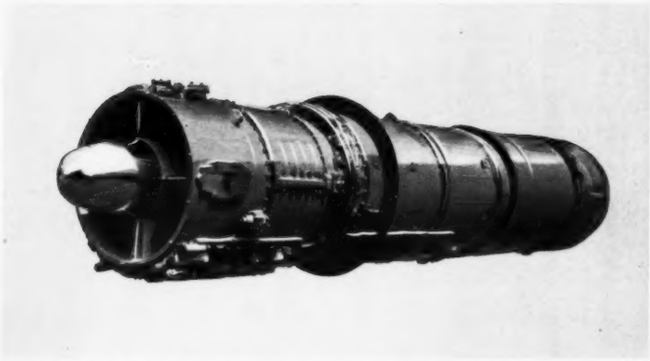
The following is a brief survey of Hispano Suiza's latest activities: production of the H.S. *Nene 105* radial-compressor jet (Rolls-Royce licence) for the MD. *Ouragan* and SE. *Mistral* fighters; production of the H.S. *Verdon* (development of the R.-R. *Tay*), fitted in the *Mystère IV A;* H.S. *Avon RA.14* (Rolls-Royce licence), used, for example, in the *Mystère IV B,* etc. Mention should also be made of Hispano Suiza's own design, the axial-compressor H.S. R-800. Although no orders have been received for this light-weight engine, the company has decided to finance construction of three R-800s, with a view to submitting them to a thorough flight test programme (the later R-804 model, for 3,300 lbs. thrust, has just successfully completed a 150-hour test run). The market for engines in the R-800 and R-804 power class is by no means saturated, and Hispano Suiza may well have some kind of a surprise up its sleeve for the Paris Show.

*

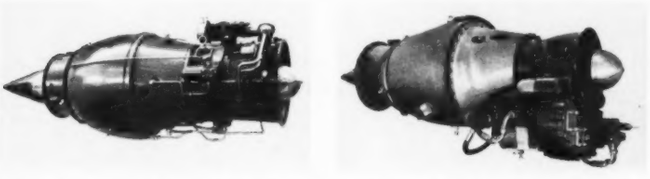
Before taking the reader on a trip to the South to visit the Turboméca works at Bordes, let us make a brief call on *Potez* at Suresnes and Argenteuil, where this company's well-tried 4, 6 and 8 cylinder in-line



SNECMA is doing pioneer work in the field of vertical take-off. Picture shows the "Flying ATAR" C-400 P-1 (remote-controlled) and C-400 P-2 (with fixed pilot seat). Another model, the C-400 P-3 will have a swivelling seat. The C-400 P-2 began free flight tests early in April.



Hispano Suiza H.S. R-804 axial-compressor jet; 3,300 lbs. static thrust.



Two of Turboméca's more recent jet engines, the *Gourdon* of 1,410 lbs. thrust (left) and *Arbizon II* of 550 lbs. (right).

Preparing for the Sunday outing. Contrary to the pessimists' accounts, sports flying activities in France are very lively.

engines are still in production in large numbers. Here the chief item of interest was the new Potez 4 D 30 with supercharger (240 h.p.), a pre-production batch of which is now being built. This engine will be fitted in the Nord 3202 two-seat trainer, destined for both the French Army and the civil flying schools, where it will replace the obsolescent Stampe biplane. Production has also begun of the 475 h.p. 8 D 32 8-cylinder engine for the Potez 75 colonial ground attack aircraft.

Another company with manufacturing and assembly plant at Argenteuil is *Société d'Etude de la Propulsion par Réaction*. Head offices are in Paris, test centre at Villejuif (near Paris); Melun-Villaroche and Istres bases are also available for ground and flight tests.

Founded in 1944, SEPR has been steadily growing in importance during the past few years, until today it holds virtually a monopoly position in the rocket motor field. It produces rocket engines not only for manned aircraft (SEPR 25 for the SO.6025, SEPR 251 for the SO.6026, SEPR 481 for the SO.9000 *Trident I,* SEPR 63 for the SO.9050 *Trident II,* SEPR 66 for the *Mystère IVB* and MD.550 *Mirage I,* and SEPR 65 for the SE.212 *Durandal*), but also for a large number of missiles (primarily air-to-surface weapons). At Istres the company is testing solid-propellant rocket motors (take-off rockets, as well as powder rocket engines as primary source of power for various air-to-surface missiles designed by MATRA, Sud-Aviation, etc.).

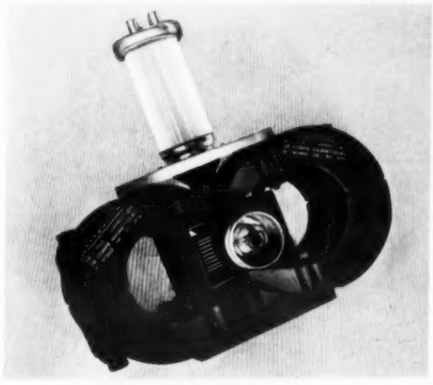
From Istres it is an easy trip to Bordes, at the foot of the Pyrenees, and location of *Turboméca's* production centre. Bordes is the birthplace of the low and medium power turbine engines designed under the direction of J. Szydlowski, the company's Chairman and Managing Director. These engines have gained a world reputation through being installed in several French aircraft which have been demonstrated in all five continents. The first to come to mind are the Fouga *Magister* and Morane-Saulnier *Paris,* both with Turboméca *Marboré II,* the SE.3130 *Alouette II* helicopter with *Artouste II* and the SO.1221 *Djinn* with *Palouste IV*. In addition, Blackburn & General Aircraft in Britain and Continental in the United States have acquired licences to build several of Turboméca's engines.

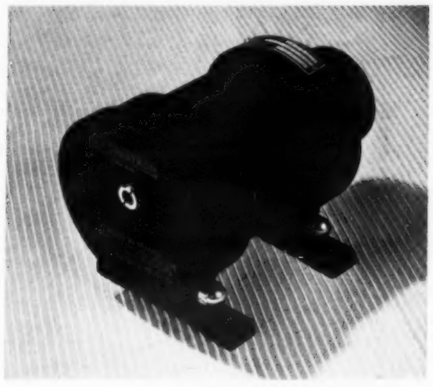
Roughly half a dozen turbojets, a similar number of turboprops and a large number of turbo-compressors are on the production programme. These include the *Gabizo* (2,420 lbs. thrust), *Gourdon* (1,410 lbs. s.t.), *Marboré II* (880 lbs.), *Arbizon II* (550 lbs.), *Soulor* (by-pass engine of 705 lbs. thrust) and *Palas* (350 lbs.) jets, the *Artouste III* (600 s.h.p.) and *Turmo III* (800 s.h.p.) shaft turbines, and the *Astazou* (320 h.p. plus 88 lbs. thrust), and *Bastan* (750 h.p.) turboprops and the turboprop version of the *Artouste III* (600 s.h.p.). Special importance is attached to the *Gabizo,* which is installed in both the twin-jet Fouga CM.171 *Makalu* and the SO.9050 *Trident II* high-performance interceptor (two Gabizos as auxiliary engines). At the end of 1956 Turboméca published first details of a version with SNCAN afterburner, which was being tested at altitudes of over 52,000 ft. in an English Electric *Canberra* flying test bed. It is no secret that *Gabizos* with reheat are to power several light-weight fighters (or ground attack aircraft) now under development. Hence a detailed examination of the Turboméca stand at the Paris Show is to be recommended, particularly as it is this company's habit to keep its trump cards back for the Show's opening day.

Recent Products of the French Telecommunications and Electronics Industry

France's place among the leaders in the field of aviation also applies in the telecommunications and electronics industry, which makes decisive contributions to aeronautical progress. Enterprises such as Compagnie Générale de Télégraphie sans Fil (CSF) and its associate Société Française Radio-Electrique (SFR), Compagnie Française Thomson-Houston (CFTH), Laboratoires R. Derveaux, Société Nouvelle de l'Outillage RBV and Radio Industrie (RI), as well as Le Matériel Téléphonique (LMT) and others, are gaining world renown for the electronic components, telecommunications equipment and installations developed and built in France.

In view of the security regulations surrounding all military equipment, the present survey must be restricted to a description of recent products for civilian use. The items discussed here were selected on the basis of officially released information and thus do not provide a representative picture of the individual companies' production programmes.

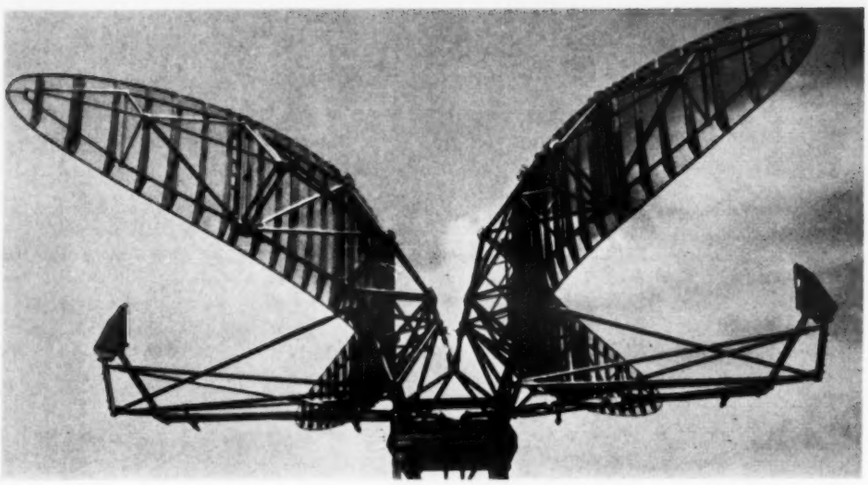




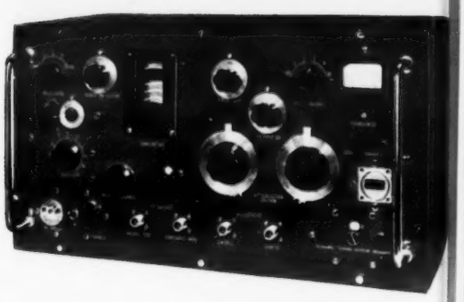
The CSF high-performance Magnetron, type MC 1053 (decimetre wave generator), shown on the *left* produces UHF/SHF energy in the S-band (10-cm waves) and is characterized by its long life and high frequency stability. The pulse power produced is greater than 1 MW; waste heat is removed by air cooling. — In the centre, the Carcinotron 0, a special variant of the self-exciting travelling wave tube for UHF/SHF (radar, remote controls, etc.), developed by CSF. Within very wide limits, the frequency can be adjusted by a simple variation in the DC voltage on the delay line. Both frequency and amplitude can be modulated with a slight control power. Six versions cover the frequency range from 1,000 to 11,000 Mc/s. — The *right-hand* picture shows a CFTH Vapotron high-power transmitter tube for long, medium and short waves. Here the waste heat is carried away by vapour cooling: water boils on the outside of the anode, the surface of which is covered with pyramid-shaped protuberances, and the heat removed in the vapour can be used to supply hot water or to heat the station premises.

Derveaux' airborne UHF transmitter-receiver (ER 146 B-2) with 24 crystal-controlled channels in the 225 to 399.9 Mc/s frequency band is designed for air–to–air and air–to–ground communications. The propagation qualities of UHF waves give line–of–sight range, though this also depends on the aircraft's altitude. Other features: output power 11 W for the transmitter, 600 mW for the receiver; type of transmission A3; output impedance 50 Ohms for the transmitter, 600 Ohms for the receiver, 70 Ohms for the microphone; wide-band antenna 50 Ohms; equipment tuning within 5 seconds by means of a switch on the control unit (not shown here); operating readiness within 25 seconds of switching on; power supply 24/30 V; dimensions 10.11 × 14.56 × 6.49 ins.; weight 39.6 lbs.

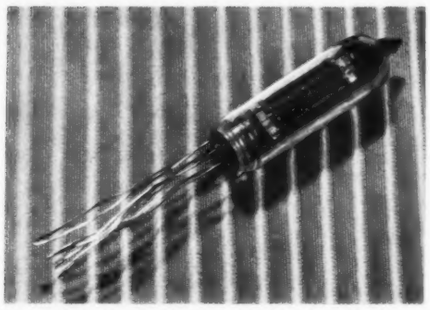
Type MX 641 portable multi-channel communications equipment with directional beam antenna (on tripod), for three or seven R/T channels in the frequency range 1,700 to 2,000 Mc/s. Makers: CSF/SFR.



CFTH's TH.D.221 radar antenna system for long-range cover, consisting of two TH.D.210 (S-band) antennae mounted back to back. The two units can be set up at different levels, so as to give both low-level and medium-level cover.



Derveaux test set (type 207) for 3-cm radar (X-band). The equipment functions as a receiver and a modulated measuring transmitter, and can be used for the following tests on radar transmitter-receivers: measurement of frequency and frequency stability, of peak transmitter power, receiver sensitivity and receiver locking delay, and checking the TR and ATR tubes.



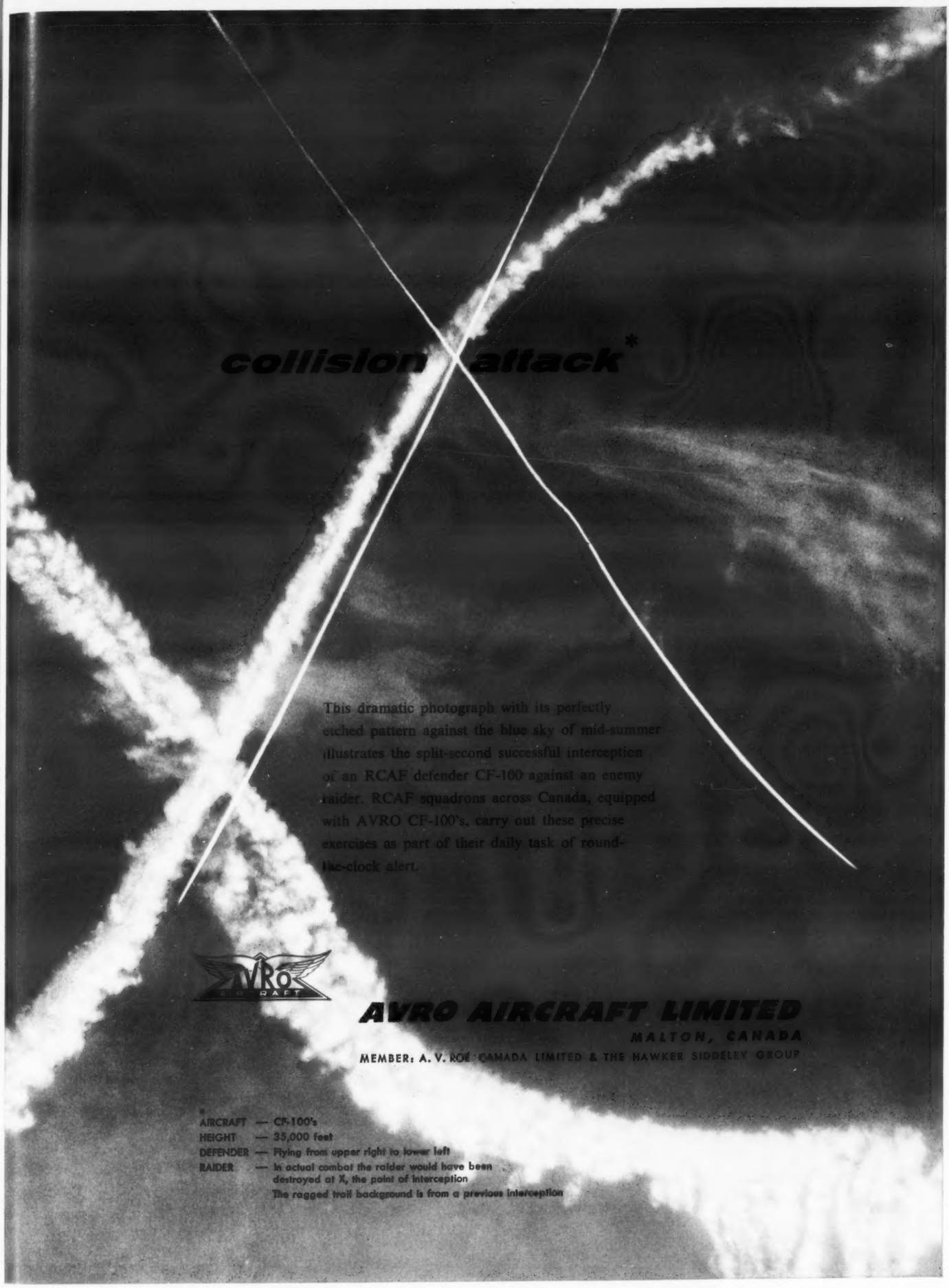
"Subnitron" is the type designation for the subminiature tubes which SFR has developed specially for use in aircraft and guided missiles. Because of their very small dimensions, the manufacturers point out, these tubes have excellent mechanical properties under the severest operating conditions.

Derveaux OR 34 precision wavemeter for the 8,600 to 9,700 Mc/s frequency band. The equipment consists of an adjustable cavity resonator coupled to a waveguide (RG-52/U). The resonator's frequency varies only slightly with the temperature, namely by $\pm$ 0.5 Mc/s for a temperature variation from $-20°$ to $+60°$C.

CSF's TCM 12 electrostatic memory tube enables consecutive electrical signals to be added or subtracted. It is used in radar receivers to suppress permanent echoes and in electronic computers.

CFTH transmitter-receiver, type TH.D.043, for the S-band radar frequency range (10-cm waves) with a peak pulse power of MW and a pulse duration of 4 microseconds.

Operations room of a radar station equipped with SFR indicators.



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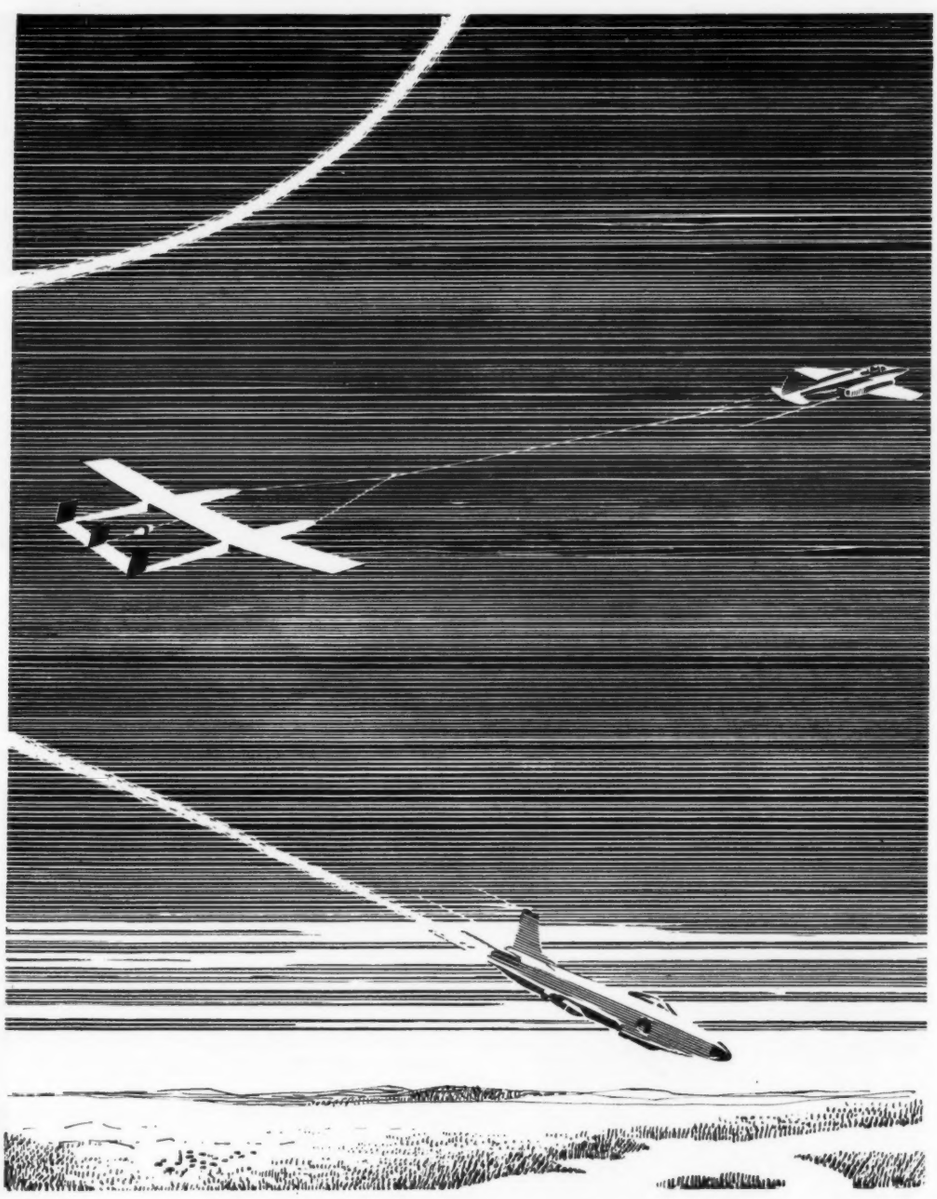

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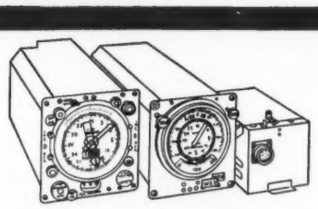

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Now completing its rigorous pre-flight test program, Canadair's CL-28 has been designed specifically as an anti-submarine aircraft for search and patrol duties with the RCAF's Maritime Air Command.

Canadair's CL-28—known to the RCAF as the CP-107—is a four-engine, very long range, long endurance sub-hunter and killer. It carries the most comprehensive collection of electronic and other detection equipment ever assembled into one aircraft for locating, tracking, and 'fixing' enemy submarines—whether submerged, 'snorting' or on the surface. Once contact is made, torpedoes, depth bombs and other offensive weapons are released.

Now in quantity production at Canadair's Montreal plants, the CL-28 becomes a major component of the NATO defences of the Western world.

European Representative: J. H. Davis, Princes House, 190 Piccadilly, London, W. 1, England

C-L CANADAIR LIMITED

CANADAIR

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• Aircraft • Research and Development
• Guided Missiles • Nuclear Engineering

A Subsidiary of GENERAL DYNAMICS CORPORATION

CA57-UK-3A

A SEVEN-JET B-47?

In this case, yes. The seventh jet, in the rear fuselage pod-mounting shown above, will be Orenda's Iroquois, designed for supersonic speeds.

The Boeing B-47 is on loan from the United States Air Force for flight testing the Iroquois in the initial subsonic phases.

ORENDA
ENGINES LIMITED
MALTON, CANADA

MEMBER A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

Paris 1957
British and Canadian Exhibits

By Interavia's London Editor

As at every post-war Paris Show, British exhibitors will be out in strength. This year there will be fewer aircraft types and a great diversity of engines and ancillary equipment. Guided weapons will be more fully represented than at any previous show, with full size units, test vehicles and a variety of components and power units. The number of exhibitors has increased by four over 1955 to a total of 42, but several earlier exhibitors have dropped out and new ones have taken their place. The firms include 13 airframe manufacturers, 6 engine builders and 23 equipment firms.

At the time of going to press, the exact extent of R.A.F. participation is not known, but it is almost certain that Fighter Command will fly over *Hunters* and *Javelins* during the display, while Bomber Command may provide "V" bombers—either *Vulcans* or *Valiants* or both.

The *Hawker Siddeley Group* will once again have a joint stand, covering Avro Aircraft, Orenda Engines, Canadian Car and Foundry, A.V. Roe, Gloster Aircraft, Armstrong Whitworth, Hawker, Armstrong Siddeley Motors and Air Service Training.—The main full size flying exhibit of the group will be the *Hunter T.7* plus CF-100's now stationed with the R.C.A.F. in France.

On the stand will be a large collection of models, the *Viper, Sapphire* and Canadian *Orenda 14 (photograph)* engines and the nose of a CF-100 showing the fire control equipment. Of the models, the display of the new AW.650 freighter/coach aircraft is the most noteworthy, the central model being surrounded by units showing the various fuselage configurations available. Gloster's recently-formed technical developments division will show items from its range, including a pressure suit, while A.S.T.'s exhibits cover toilet servicing units, the Mk.2 liquid carrier and 1-in. and 4-in. guide release blanking caps and connectors.

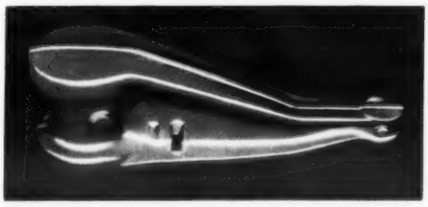
On a separate stand High Duty Alloys, another group member, will have a 960-lb, main undercarriage forging in Hiduminium (R.R.77) for the *Caravelle*, wing spar forgings for the *Friendship*, precision forgings in stainless steel and, for the first time, titanium *(photograph)*.

The *English Electric Group* stand will cover the aircraft division, the guided weapons division, the aircraft equipment division, the Napier Engine Co. and Marconi's.

The P.1 will be represented by a 6 ft. model, together with 4 ft. models of the *Canberras* T.4 and B.8. No details are as yet available, but the guided weapons will show representative items, presumably connected with the company's advanced ground-air anti-aircraft rocket. Generators, convertors, alternators, control panels and rotary and linear actuators will form the Equipment Division's contribution. Pieces from the now well-known "Deuce" computer will also be on show.

Napier's main exhibits will be the *Eland* and the *Gazelle*, and interest in the former will be heightened by the recent announcement that the Brazilian airline R.E.A.L. is to convert its Convairs to *Eland* power. It is possible that the *Eland-Convair* converted by Napier may be flown to the show with its new 3,500 h.p. NEl.6's installed.

The Napier company is deeply engaged in guided weapons development, and their activities in this field will be covered by a typical



High Duty Alloys precision forged torque link in I.C.I. titanium alloy No. 314A: weight 11 lbs.

Paris Air Show

By Viscount Caldecote, D.S.C., A.M.I. Mech. E., Director, The English Electric Company, Limited

This month's Paris Air Show differs from the annual display of the S.B.A.C. at Farnborough chiefly, of course, by being an international event. For this reason the majority of British aircraft constructors and many others in the industry support the Paris Salon as an important factor in their export drive which encourages the sales not only of complete aircraft, such as the *Britannia*, *Canberra*, *Hunter* and *Viscount*, but also of engines and components of all kinds. The success of these efforts is shown by the fact that during 1956 Britain exported aircraft, engines and accessories valued at over £104,000,000, or 58 per cent more than in 1955, the year of the last Paris Show.

It is a good opportunity too for those in the British industry to inspect the products of other countries and to compare them with their own for, while British manufacturers are wide awake to the excellence of the products of their competitors, they are keen to show their wares side by side. Visitors to Paris will see that the aircraft, engines and the wide range of components made in Britain compare well with those of other countries. Already the *Britannia* shows good promise of following the *Viscount* into the American airlines. New British engines too, such as the *Eland*, *Olympus* and *Tyne*, are now well known all over the world and are recognized to be superior to any other engines in their class. The British industry is proud too that the Fokker *Friendship* has British engines, undercarriage and instruments and that the Sud-Est *Caravelle* has British engines and even its nose section was designed in Britain.

Many British manufacturers, therefore, welcome the opportunity that the Paris Air Show gives to buyers from all over the world to see their products without coming to Britain and to see them side by side with similar equipment from other countries. We in the British aircraft industry do not expect to see many representatives from airlines or air forces placing orders with us at Paris, but we do hope to see them on our stands, and on other people's too, and then in a few months time to welcome them in our factories and our offices when they come to place their orders. The British aircraft industry, the largest in Europe, is out to get orders: it is seeking them throughout the world, and the whole world goes to Paris.

The Hawker *Hunter T.7* two-seat fighter trainer will take part in the flying display at Paris . . .

. . . as will also the Avro-Canada CF-100 twin-jet all-weather two-seater, with which the R.C.A.F. squadrons stationed in Europe are equipped.

Handley Page plans to send the 44-seat HPR.3 *Herald* airliner (four Alvis *Leonides Majors*) to Paris for a few days.

single chamber rocket motor, ramjet models and another guided weapons rocket engine. Visitors will be able to examine in detail the rotor tip jet units fitted on the Saunders Roe *Skeeter*, which will be in the flying display. There will be a few *Spraymat* anti-icing exhibits, but the main demonstration of this process will be on the stand of Bronzavia, who hold the French licence.

Marconi's two equipments on show will be the type AD.712 automatic direction finder and the type AD.722 sub-miniature radio compass. The type 712, which was demonstrated publicly for the first time in January, has been developed to meet the requirements of the latest high-speed transport aircraft. It is particularly suitable for pilot operation and provides facilities for Consol reception, etc. Frequency selection is effected in steps of 0.5 kc/s over a range of 100–415 kc/s and 490–1,799.5 kc/s. This simple method of tuning has been made possible by a unique automatic crystal-controlled tuning mechanism which ensures that the receiver frequency is accurate to within $\pm$ 50c/s under all normal conditions. The AD.712 is the only ADF with this facility.

India has placed a contract with Marconi's for the supply of a quantity of the sub-miniature Radio Compasses type AD.722, and these are installed in Indian Air Force fighters. The AD.722 has also been selected for the three N.A.T.O. light-weight fighter prototypes and has already flown in the Fiat G.91. Of exceedingly small weight and size the equipment is suitable for unpressurized operation at high altitudes (up to 70,000 ft.). The complete installation weighs only 22 lbs.

Another large British group in the exhibition, the *Bristol Aeroplane Company*, will have a *Britannia* airliner in the static park for the first three days and another (possibly a 300) in the June 1st and 2nd flying displays. Two *Sycamore* helicopters will be kept fully occupied, one being used for a shuttle service between the centre of Paris and Le Bourget.

Models on the stand will include *Britannias* in B.O.A.C., R.A.F. and Northeast Airlines colours, the *Sycamore*, the twin rotor type 192, and sectioned drop tanks for *Hunters*, *Seahawks* and *Venoms*. A full-scale Bristol *Bobbin* guided weapons test vehicle will be included, plus rocket motor tubes, pressure vessels etc., for missiles.

The *Bristol Engine Company* will have an *Orpheus 3* on the stand, which type of engine will also be in the flying display as the power plant for the Folland *Gnat*, Dassault *Etendard 6*, Breguet *Taon* and Fiat G.91 light fighters. Other Bristol power units will include the giant 16,000 lb. thrust *Olympus 6*, the sectioned *Proteus 705* and the *Thor* ramjet.

Fairey will be sending the Ultra Light helicopter on its standard British Army 3-ton truck. This vehicle carries the aircraft, the pilot, spares, fuel and provisions, forming a completely self-sufficient mobile unit. There is also a possibility that a *Gannet A.S.Mk.4* and *Gannet T.Mk.2* will be shown. The record-breaking Fairey FD-2 may also put in an appearance.

Indoors will be the Fairey *Fireflash* air-to-air guided weapon, now in production for the Royal Air Force, mounted on its trolley. A further *Fireflash* will be exhibited on an Operational Airfield Test Set. Models and diagrams will indicate the scope and application of the *Rotodyne* 40-seat helicopter. Of particular technical interest will be a section of the Fairey Delta 2's wing made in Perspex through which can be seen the operation of the hydraulic undercarriage. Various types of Fairey Power Controls will also be shown; these are fitted to such aircraft as the Fairey Delta 2, the Avro (Canada) CF-100, Hawker *Hunter*, the English Electric *Canberra Mk. 9*, the Vickers *Supermarine N.113*, the Blackburn *Beverley*, the Aerfer *Sagittario II* and the Fiat G.82.

Two helicopters will form the Westland exhibit, the five-seater *Widgeon* and the Alvis *Leonides Major*-powered twelve-seat S-55 *Whirlwind*.

Making a welcome return after ten years' absence from the Salon will be *F. G. Miles Ltd.* with exhibits in the static show. The HDM-105 (*Aerovan* with Hurel-Dubois wing and two *Cirrus Majors*), forerunner of the HDM-106 light transport, will be flown, while on the Hurel-Dubois stand will be certain F. G. Miles Ltd. electronic components, including a computer rack as used in their flight simulators.

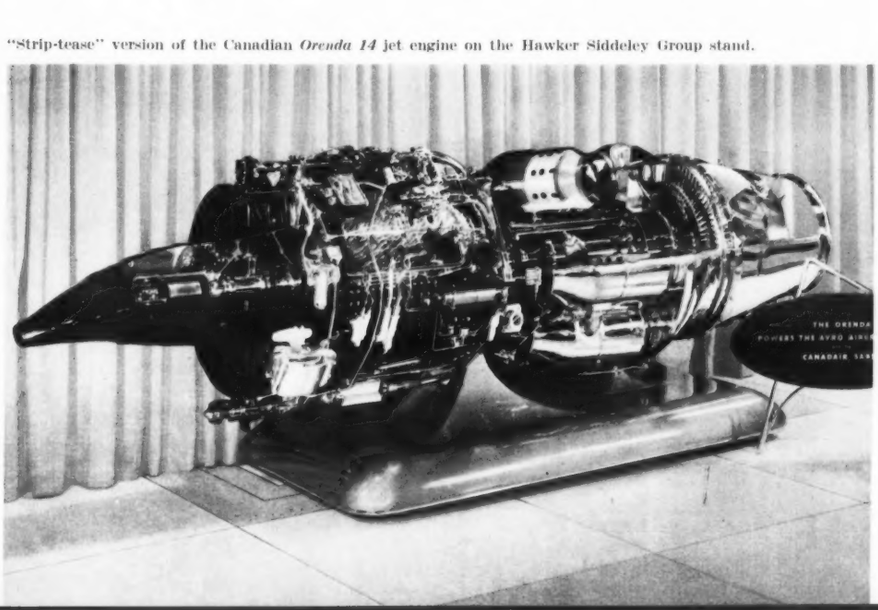
Two newcomers will be Folland and Edgar Percival. Folland will have *Gnat* models and a compressed air starter trolley on the stand, and in the flying display a fully equipped and armed *Gnat Mk. 1* from the batch of six ordered by the Ministry of Supply. Edgar Percival will not have a stand, but will demonstrate two of his EP. 9 light transport, agricultural top dressing aircraft *(photograph)*.

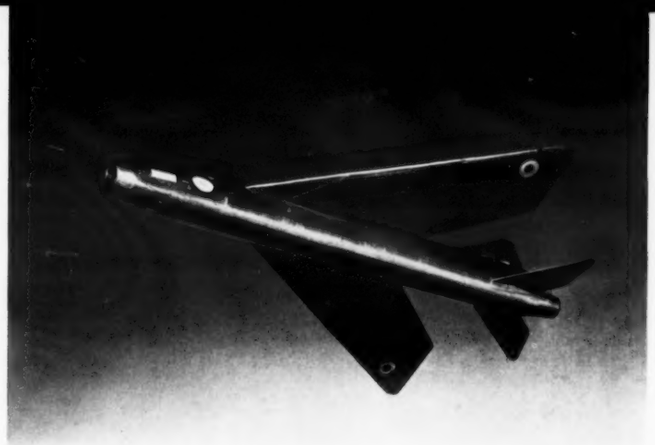
Saunders Roe will share their stand with *de Havillands*, but main interest will centre on the outdoor exhibit of the *Skeeter* with Napier HTP boost units at the rotor tips. Although *Handley Page* will not have an indoor stand, the 44-seater *Herald* branchliner with four *Leonides Majors* will be flown to Paris for two days during the Show.

With half the turboprop and turbojet airliners ordered in the Western World powered by their engines, *Rolls-Royce* will be in a unique position among the engine firms exhibiting.

The *Conway* by-pass engine range will be represented by an RCo. 5 *(photograph)*, the *Avon* series by an RA.26 and the turboprops by an RB.109 *Tyne* and a *Dart* RDa.7. The company will be well covered in the flying display with the *Hunter*, the *Caravelle*, the *Friendship*, the *Alizé* and several other types powered by Rolls engines.

"Strip-tease" version of the Canadian *Orenda 14* jet engine on the Hawker Siddeley Group stand.





From ultra-light aircraft to supersonic fighter – or 35 years of aircraft development at English Electric: the 1922 single-seat *Wren* (with 50 h.p. ABC engine) is still flying . . . as a pastime for supersonic pilot P. Hillwood, who normally flies the P.1 (right).

Main *Alvis* exhibits will be the *Leonides Major* 870 h.p. radial as fitted to the Handley Page *Herald* and Westland *Whirlwind,* and the *Leonides series 2* engine which powers such types as the *Twin Pioneer* and the Hunting Percival *Pembroke (photograph).*

This year de Havilland Aircraft are not showing, and it is the *D.H. Engine Company* which has pride of place, with a massive 20,000-lb. *Gyron* complete with reheat and variable nozzle, and the *Gyron Junior* also with reheat, which will be contained in a mock-up fuselage for a typical mixed power plant (rocket plus jet) installation. The only D.H. piston engine will be the *Gipsy Major 200.*

The *Rotol* stand will include exhibits from their associate company, *British Messier Limited.* The company's central exhibit will be the 12 ft. propeller for the Fokker and Fairchild *Friendship* airliner. There will also be accessory drive equipment for *Viscount* aircraft, a range of air turbine motors driving direct from the turbine engine compressors, a power-driven fuel flow proportioner similar to the unit which was exhibited at the last Paris Show, but with the addition of hydraulic power to drive the proportioning vanes, and a ram air ten-bladed, single turbine unit directly coupled to a small hydraulic pump. Undercarriages will be those for the *Britannia* airliner, and the Folland *Gnat* light fighter, and in addition there will be the 4873 motor pump unit, a selection of British Messier sectioned hydraulic units, and the air brake for the Vickers *Viscount.*

The many-sided activities of the *Dowty Group* as applicable to the aircraft industry will be exhibited on one combined stand. Undercarriages include sectioned examples of the main wheel units as fitted to the *Hunter* and *Javelin,* a nose wheel unit from the *Sea Hawk,* and the twin main wheel unit fitted to the Fokker *Friendship.* Each of these embodies the Dowty Liquid Spring shock absorber. The 4,000 p.s.i. *Vardel* hydraulic pump will be shown in its latest form as the *Super Vardel,* together with an example of the type of fuel system as fitted to the *Gyron* engine, circuit fuel system, electrical equipment and seals.

Standard Telephones and Cables will have their usual wide range of sets: the STR.12D, 140-channel airborne VHF (standard equipment on *Comets, Britannias* and *Viscounts*); STARN.21 airborne TACAN navigational equipment; automatic-tuning and 44-channel conversion kit for the STR.9X; 10-channel VHF airborne communication equipment; A.1205 airborne catastrophe warning device (which produces electronically an urgent "firebell" sound in the pilot's headphones when operated by any of a number of emergency conditions); airborne radio teleprinter installation; the A.2209 goniograph; and aircraft aerials.

For the first time, the Commutated Antenna Direction Finding Equipment will be shown. The C.A.D.F. is a revolutionary method of r.d.f. applicable to the HF, VHF and UHF bands. The system offers a major reduction of site errors up to 10 times better than a conventional Adcock system.

The *Decca Navigator Company* will be represented on the stand of their licencees, Société Française Radio-Electrique, where the new Mk.10 Decca receiver will be operated on the English chain, and there will be an exhibition of Dectra components. Decca have chartered

Other British aircraft entered for the flying display include Edgar Percival's six-seat EP.9 (above) and F. G. Miles Limited's HDM-105 high-aspect-ratio-wing transport.

Alvis *Leonides Major* two-row radial engine (870 h.p. take-off rating).

Rolls-Royce *Conway* by-pass jets will be installed in many of the Boeing 707 and Douglas DC-8 transports.

a *Sycamore* helicopter which will fly between Issy and Le Bourget and which will be equipped with the Decca navigator and Flight Log.

C.T. London, Ltd., will have a joint stand for four of the British firms it represents overseas: Martin-Baker Aircraft Co. Ltd., Mechanism Ltd., Murphy Radio Ltd. (Electronics), and R.B. Pullin and Co. Ltd.

Martin-Baker will have their fully automatic light-weight ejection seat which is designed to function efficiently at all operating speeds and heights (down to ground level) of which modern military aircraft are capable. The installed weight, when fitted with the 80 ft./sec. telescopic gun, is only 80 lbs. The latest design incorporates in the time release a mechanism sensitive to ejection speed which selects the time delay required by the environmental circumstances.

Mechanism Limited have a combined speed indicator M.1765 (Mach number and indicated air speed in knots; ranges: 80–250 knots and 0.3 M to 2.0 M), two Machmeters, Fatigue Meter Mk. 1B, Altitude Switch Type M.1817, "Stand-By" Instruments, Stand-By altimeter type M.1874, Stand-By Air speed indicator type M.1861, and various transmitting instruments.

The electronics division of *Murphy Radio Limited* will include in their display radar beacon RB.110, a transponder which will operate at frequencies between 190–240 Mc/s, forming the ground installation for use by aircraft fitted with interrogating equipment such as the Murphy D.M.E. Furthermore: airborne navigational aid *Rebecca 8,* beacon control equipment MR.255, M.R.500 VHF pulse generator, MR.300 44-channel VHF aircraft transmitter/receiver, MR.80 and MR.100 VHF aircraft transmitter/receiver, MR.800 and MR.862 VHF radio telephone equipment, aircraft voltage regulator VR61B., and passenger announcement equipment MR.320.

R.B. Pullin will have the precision tachometer generator R.701, servomotors, permanent magnet motors to be operated from 28 volt D.C. or on other models for 12 volt D.C., and electrical turn and slip indicators.

There will be several new developments on the *British Communications Corporation* stand including a multichannel automatic recording system, designed to meet both I.C.A.O. and military requirements, flight deck communications system for aircraft carriers, and a new range of VHF mobile and fixed stations for all aeronautical ground/air and ground/ground applications.

The *Rotax Company* will display their very wide range of switch gears, D.C. generators, alternators, invertors, control panels, a carbon pile voltage regulator, voltage protection unit, high energy ignition units, fibreglass air bottle and valve, and a small hand de-icing pump.

The versatility of "Redux" bonding in aircraft construction will be the main theme of the *Aero Research Limited* display. A range of different types of "Redux" bonded metal honeycomb for aircraft and in particular metal honeycomb flooring applications will be featured. A typical fuselage section will demonstrate the advantages of this unique form of construction.

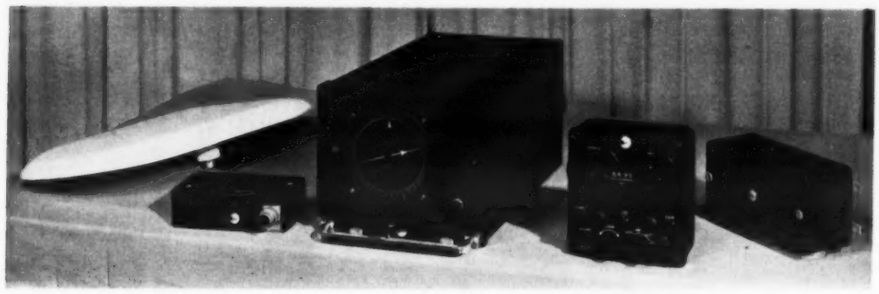
Cossor Radar Ltd. will have their latest CR.21 high power S-band surveillance radar in a complete self-contained trailer. The CR.21 will visit Paris as part of a European tour lasting over three months and covering Holland, Belgium, France, Germany, Austria, Switzerland, Denmark, Sweden and Norway.

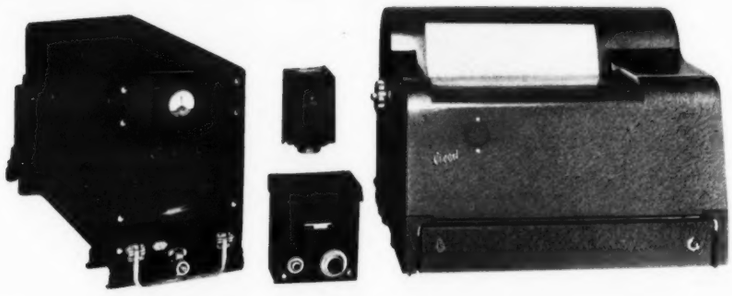
A range of aero engine and airframe components made in High-Nickel Alloy will be the main exhibit of *Henry Wiggin,* and *Vactric Limited* will have international frame size servo components covering A/C units, D/C units and servo gear heads. There will also be a telemetry switch and Breadboard Components *(photograph)* shown by Vactric, whereas a first class Slumberette seat for B.O.A.C., a tourist class seat for Aer Lingus, radomes, electrical equipment and dielectric test sets will make up the *Microcell* contribution.

Lodge Plugs Ltd., will have aircraft sparking plugs, high energy ignitors, while *H.M. Hobson* will demonstrate powered flying controls of various types, feel simulator controls, auto stabilizer servo actuators, air/fuel ratio controls, pressurized reservoirs, speed governing fuel control units and gas turbine engine accessories. A model exhaust cone and jet pipe complete with insulation blanket and various other types of high temperature insulation blankets, will be on the *British Refrasil* stand, and the *Sperry Gyroscope Co.* will show a representative range of instruments including the AL.30 gyropilot.

Finally, *Normalair Ltd.* will display cabin air conditioning and pressurization equipment including air cycle cooling turbines, automatic flow controllers, passenger oxygen sets and liquid oxygen converters. Of special interest to sports pilots will be the light-weight oxygen component *(photograph)* that was used in the 1956 gliding championships at St.Yan, France.

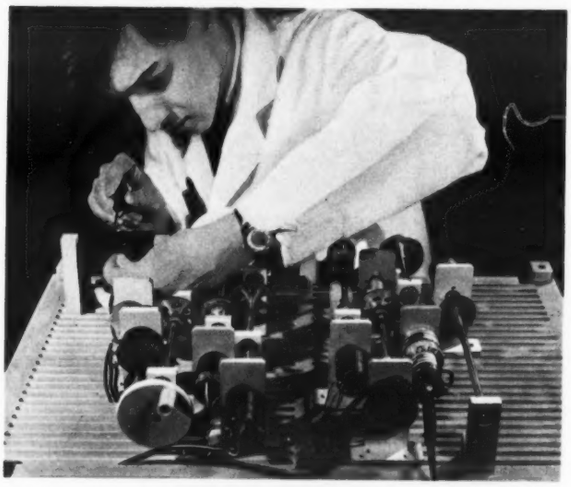
The main components of Marconi's new AD.712 automatic direction finder; left to right, the fixed loop aerial, quadrantal error correction unit, receiver, control unit and controller change-over switch unit.

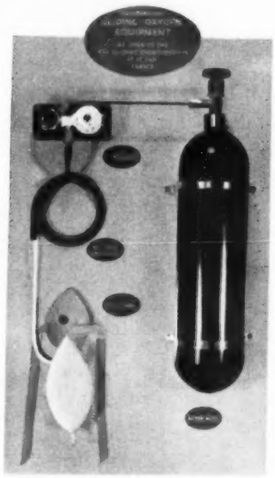




Standard Telephones and Cables radio receiver and Creed teleprinter for airborne installation.

Construction kit of Vactric (Control Equipment) Limited, for the makers of all kinds of servo mechanism. Light-weight oxygen equipment for sports pilots, consisting of oxygen bottle (right), flow selector (top), tube assembly (centre) and L mask with oxygen bag; weight 8.8 lbs. (400 litres) or 12.7 lbs. (750 litres).





Italy's Contribution

By Interavia's Rome Correspondent

Agusta-Bell 47J helicopter, with 260/223 h.p. Lycoming engine.

Five Italian aircraft manufacturers, two of whom also produce aircraft engines, will be exhibiting in Paris, under the auspices of their national industrial association, the *Associazione Imprese Aeronautiche*. They are Aeronautica Macchi, Agusta, *IMAM-Aerfer, Fiat and Piaggio*.—Since the last Paris Show in 1955, these companies have come forward with new, and in most cases impressive, designs, three of which—the Aerfer *Sagittario 2*, Fiat G.91 and Piaggio P.149D—are scheduled to take part in the international flying display at Le Bourget, while the others will be shown in the form of models and photographs.

Alfa Romeo, SIAI-Marchetti and a number of other firms, who are at present engaged—apart from projects—merely in maintenance and overhaul activities, will not be present in Paris. On the other hand, *four equipment manufacturers* will be there with selected products, representing a very large number of Italian specialist firms in this sector.

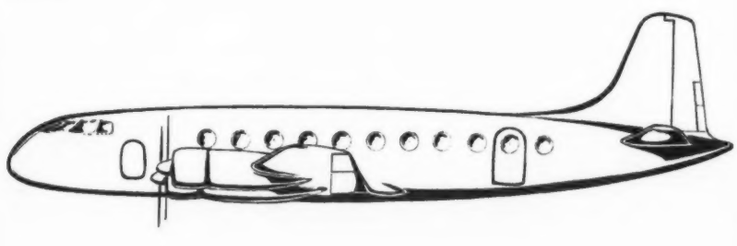
*

To begin with the aircraft manufacturers in alphabetical order, *Aeronautica Macchi*, of Varese, is showing a model of the new *Macchi MB.326* jet-powered elementary trainer. This elegant design by Engineer Ermanno Bazzocchi (span 32.8 ft., wing area 205 sq. ft., gross weight 5,950 lbs., engine take-off thrust 1,750 lbs.) is powered by an Armstrong Siddeley *Viper ASV.8* jet and destined for the all-through jet training of military pilots, from first flight to armament training. Conventional preliminary training on piston-engine aircraft is thus to be discarded in future. Acrobatic exercises can be carried out in this aircraft at moderate altitudes, though navigation exercises will be made at greater altitudes, to reduce consumption. The MB.326's critical Mach number will be 0.8. A special, armed version (MB.326A) is to be used for training in aerial warfare and ground attack missions. In addition, it is planned to increase the engine thrust later to 2,200 lbs. It may be noted that the single-jet configuration for military trainers is given preference in Italy over the twin-jet layout chiefly for reasons of economy.—Macchi is also showing the well-known *MB.320* twin-engine touring aircraft, which is in use in East Africa, as well as photographs of its remaining production: parts for the Lockheed T-33 jet trainer and the Republic F-84 and North American F-86K fighters; overhauls and repairs.

The design activities of *Costruzioni Aeronautiche Giovanni Agusta*, Gallarate, will also be illustrated by a model, that of the *AZ.8L* designed by Engineer Filippo Zappata. Two prototypes are under construction at Agusta. With four engines (Alvis *Leonides 502/5*

Model of the Macchi MB.326 jet-powered basic trainer, with Armstrong Siddeley *Viper 8* (1,750 lbs. s.t.).

Drawing of the Agusta-Zappata AZ.8L medium-haul aircraft, with four 540 h.p. Alvis *Leonides*.



The Aerfer *Sagittario 2* light-weight fighter has its jet engine (Rolls-Royce *Derwent 9* of 3,600 lbs. s.t.) in the nose; the jet pipe runs underneath the fuselage.

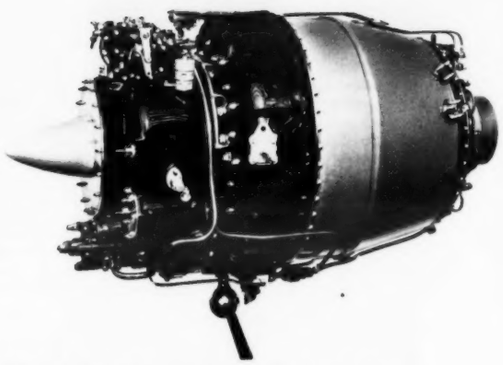
of 540 h.p. take-off rating), a span of 83.8 ft. and a wing area of 718 sq. ft., they have a gross weight of 23,800 to 24,900 lbs. and will be able to carry 22 passengers over medium distances. Design take-off distance to 50 ft. is only 1,770 ft., so that they will be able to operate from practically all airfields. A high-density version for 26 passengers and a pure cargo version for 5,500 lbs. payload are also planned, while an ambulance version would take 12 stretcher cases. If fitted with four 600 h.p. SNECMA 12S engines, the aircraft will bear the designation AZ-8S. In view of the moderate altitude at which it will cruise, the AZ-8 is not pressurized. Agusta is also exhibiting the latest version of the Bell helicopter built under licence, under the designation *Agusta-Bell 47J*. Powered by a Lycoming VO-435 of 260/220 h.p. take-off rating, this helicopter can take off with a load of 1,010 lbs. (gross weight 2,560 lbs.) and has seats for four persons (or three when special equipment is carried). Service ceiling with full load is 16,500 ft., or 21,500 ft. with reduced load; hovering ceiling with ground effect 9,800 ft. and 15,900 ft. respectively. Agusta has already sold a considerable number of its helicopters both inside and outside Italy and has also recently come out with a project for a rotary-wing aircraft of its own design, the *Agusta X.1* (also to plans of Engineer Zappata).

Industrie Meccaniche Aeronautiche Meridionali Aerfer, Pomigliano d'Arco, will be displaying, above all, its *Sagittario 2* light-weight prototype, the first in a planned development series of interceptors. Project engineer for this aircraft, which is fitted initially with a Rolls-Royce *Derwent 9* (3,600 lbs. static thrust) and has a gross weight of only 6,600 lbs., is Engineer Sergio Stefanutti. One of the designer's main objects was to make a practical contribution towards reducing the cost of the fighter force by radically cutting down all dimensions and weights. To do this, he has followed a new approach, both from the aerodynamic point of view and in the arrangement of the jet engine in the fuselage nose. As the jet pipe could be placed beneath the fuselage floor, there is a relatively large space in the centre portion of the fuselage for armament and fuel. The latter is carried in the immediate neighbourhood of the aircraft centre of gravity. Two Hispano Suiza 30-mm cannon with a respectable supply of ammunition are to be installed. Take-off distance is said to be no more than 1,500 ft., and landing distance 1,650 ft., and both take-off and landing on grass fields should be possible. Time of climb to 39,400 ft. is given as ten minutes, and maximum level speed as 566 knots. Permissible Mach number in a dive will be 1.1. Aerfer also plans to build a *supersonic version of the Sagittario 2.*—In addition, the company supplies parts for the F-84F and G. It overhauls and repairs the Italian Air Force's jet fighters and the aircraft of the U. S. Navy units stationed in Europe, and is engaged in the development of a remote-controlled target drone to the design of Engineer Amilcare Porro.

Fiat, Turin, has entered one of the prototypes of its *Fiat G.91* jet-powered ground attack aircraft for the flying display. Three prototypes and 27 pre-production models of this aircraft by the well-known designer Professor Giuseppe Gabrielli were ordered when the Fiat specification emerged victorious over seven other European designs in a N.A.T.O. contest. The G.91 is believed to have unusual advantages as regards armament, as well as take-off and landing qualities on small airfields. Its reduced dimensions and weight are expected to cut purchase and operating costs and hence, in conjunction with an appreciably simplified ground organization, to provide the

The Fiat G.91 ground attack aircraft for N.A.T.O., during a landing with ribbon parachute. Power is supplied by the Bristol *Orpheus 3* of 4,850 lbs. thrust.

Fiat G.82 two-seat jet trainer (with Rolls-Royce *Nene* of 5,000 lbs. or 5,400 lbs. s.t.) for the Italian Air Force.



The Fiat 4002 radial-compressor engine is available with a thrust of either 550 lbs. or 660 lbs.; engine speed 26,000 r.p.m.

best possible solution to meet Western Europe's economic and technical requirements. At N.A.T.O's request, the Bristol *Orpheus 3* (4,850 lbs. static thrust) will be fitted. The first prototype (since crashed) left the factory within a year of the contract's being awarded. Results of the test flights so far made are classified, but it is reported that the aircraft exceeded Mach 1 on repeated occasions and that flight testing will be continued by the other two prototypes.

Wall panels and models will also illustrate the company's varied history since 1908. In the intervening five decades no fewer than 157 aircraft types and 51 engine types have been brought out. Today the greatest importance seems to be attached to the *Fiat G.82* two-seat jet trainer. Also designed by Engineer Gabrielli, it is powered by a Rolls-Royce *Nene 2|21* (5,000 lbs. thrust) or *Nene 6|21* (5,400 lbs.). Span 38.6 ft., wing area 269 sq. ft., normal gross weight 13,800 lbs., maximum speed (with *Nene 6|21*) 500 knots, stalling speed 100 knots, climb to 19,700 ft. in 4.5 mins., to 29,600 ft. in 8.25 mins., service ceiling 42,700 ft., range at 313 knots cruising speed 620 nautical miles, take-off distance 1,970 ft., landing distance 2,780 ft.—The *North American F-86K* (General Electric J-47-17B jet) built by Fiat for several N.A.T.O. countries will also be on show in model form.

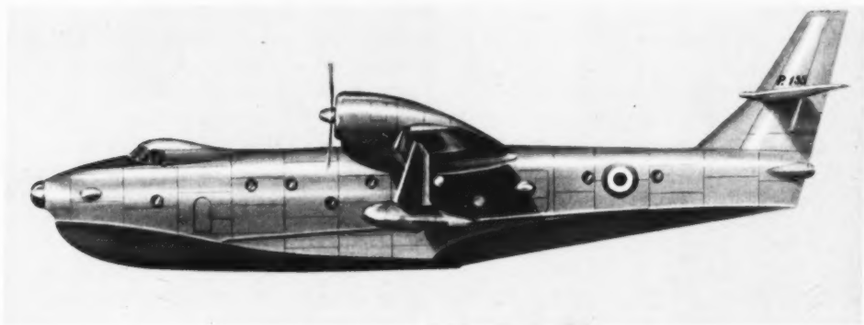
Finally, the *Fiat 4002 jet engine* designed by Engineer Mancini will be exhibited. The visiting card of the Turin aircraft engine division, this small power unit is available in two versions, with 550 lbs. and 660 lbs. thrust respectively, and is suitable for installation in smaller experimental sports and trainer aircraft. It has a radial compressor with annular combustion chamber, and a single-stage turbine. Air mass flow 11 lbs./sec., operating speed 26,000 r.p.m., compression ratio 1:4, diameter 22.4 ins., length 40.7 ins., weight 220 lbs.

Piaggio & C., Genoa, will be demonstrating the *Piaggio P.149D* 4/5-seat touring aircraft in flight. This aircraft has recently been ordered in substantial numbers by the West German forces for training and communications purposes. Designed by Professor Giovanni Casiraghi, it is in production both at Piaggio's Genoa plant and at Focke-Wulf in Bremen. Power plant consists of Lycoming GO-480-B1 engines of 270 h.p. take-off rating, with Piaggio 1033 G3 three-blade v.p. propellers. Maximum speed 160 knots at 3,280 ft., take-off distance to 50 ft., 1,330 ft., landing distance 670 ft., service ceiling 16,400 ft. The P.149D climbs to 3,280 ft. in 3 mins. 25 secs. and is fully aerobatic. Gross weight is 3,190 lbs.

Models and pictures will again illustrate the *Piaggio P.136L* five-seat amphibian, which has been in service with the "*Aeronautica Militare Italiana*" for some years and is also built in two civil versions both in Italy and under licence in the United States (by Trecker Aircraft Company, Milwaukee). The *L1 version* has two Lycoming GO-480-B1 engines (270 h.p. take-off rating), the *L2* has two supercharged Lycoming GSO-480-A1s (340 h.p. take-off rating). Maximum speed around 160 knots. The aircraft (known as the *Royal Gull* in the United States) is in use as a private touring and charter aircraft, as well as with the Customs and sea rescue services. It is also employed on whaling expeditions.—Another model will represent the *Piaggio P.155* large amphibian, which is now nearing completion and is to be produced in *three sub-versions*. The *SAM.1 version* is designed for sea rescue duties and will have two Pratt & Whitney R-2800 piston engines, probably of 2,400 h.p. take-off rating. The *AS version* will be used for naval reconnaissance and anti-submarine purposes and is reportedly to be powered by two turboprops of undisclosed type and auxiliary jets. The *CT version* is a commercial model and will have two turboprops in the 3,000 to 4,000 h.p. class. Accommodation for a crew of seven, ten stretcher cases and 5 to 10 other passengers will be provided in the sea rescue version (SAM.1); the commercial version (CT) will carry 20 to 30 passengers; the equipment of the anti-submarine model (AS) is, of course, secret. It is also reported that the SAM.1 will have cruising speeds of 140 to 190 knots and a range of around 2,000 nautical miles.

Piaggio P.149D touring and communications aircraft, with 270 h.p. Lycoming GO-480 B1 engine and Piaggio three-blade propeller.

Driving up to the service station . . . in the Piaggio P.136L five-seat touring and Customs amphibian (two 270 h.p. or 340 h.p. Lycoming engines).

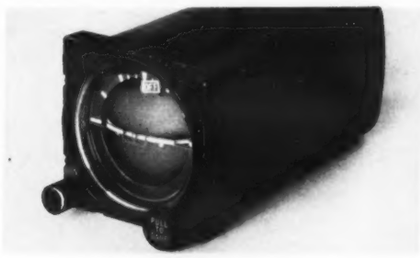


SAM.1 sea rescue version of the Piaggio P.155 amphibian, with two 2,400 h.p. Pratt & Whitney R-2800 piston engines.

Model of the seven-seat Piaggio P.166 executive aircraft (two 340 h.p. Lycoming engines).

Practice napalm bomb (weight 100 lbs.) of Soc. An. Aerea, Milan.

J8-R attitude indicator (Bendix licence) made by Microtecnica, Turin.



Finally, Piaggio is showing a model of yet another new design, the *Piaggio P.166* executive aircraft. With two supercharged Lycoming GSO-480-A1 engines of 340 h.p. take-off rating, it will have room for seven persons, a maximum cruising speed of 178 knots and an economic cruising speed of 154 knots. Gross weight 7,050 lbs.; useful load 2,420 lbs.; maximum range at economic cruising speed roughly 1,080 nautical miles; service ceiling 25,200 ft. (on two engines) or 11,200 ft. (on one engine); take-off distance to clear a 50 ft. obstruction 1,580 ft., landing distance from 50 ft. 1,640 ft.—An original *Lycoming GO-480 B1.A6* (take-off rating 270 h.p.), built under licence at Piaggio's Finale Ligure plant, will also be on show, together with its Piaggio three-blade propeller.

*

Among the accessories manufacturers—once again in alphabetical order—*Aerea,* Milan, will show practice bombs, while *Microtecnica,* Turin, will be represented by various small electric motors (Bendix licence) and the well-known *J8-R attitude indicator* (also Bendix licence). *Officine Viberti,* Turin, will be advertising its BVF 203 salvage vehicles (for 30-ton loads), the "Semirimorchio" (semi-trailer, for 60 tons) and fire-fighting and fuelling trucks, while the Milan electrical firm of *Veam* will exhibit multiple electric plugs, relays and coaxial cable connections.

*

The overall impression to be gained from this year's Paris Show will thus be that the Italian aircraft industry has made notable progress in both qualitative and quantitative respects and occupies a high position on the national and international levels.

AFTER THREE YEARS OF SYSTEMATIC TESTS ON SUCCESSIVELY IMPROVED PROTOTYPES

THE T.P.C. RADAR SYSTEM

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FOR THE FIRE CONTROL OF MEDIUM-CALIBRE ANTI-AIRCRAFT BATTERIES IS NOW IN

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WARNINGS stand out brilliantly and positively when faced with "SCOTCHLITE" Reflective Sheeting. "SCOTCHLITE" Signs show the same shape, same legend, and same color at night as they do by day.

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ENGLAND . . . Minnesota Mining & Mfg. Co., Ltd., Arden Road, Adderley Park, Birmingham 8

FRANCE . . . Minnesota de France, 135 Boulevard Serurier, Paris 19me

GERMANY . . . Minnesota Mining & Mfg. Co. m.b.H., Immermannstrasse 40, Düsseldorf-Reisholz

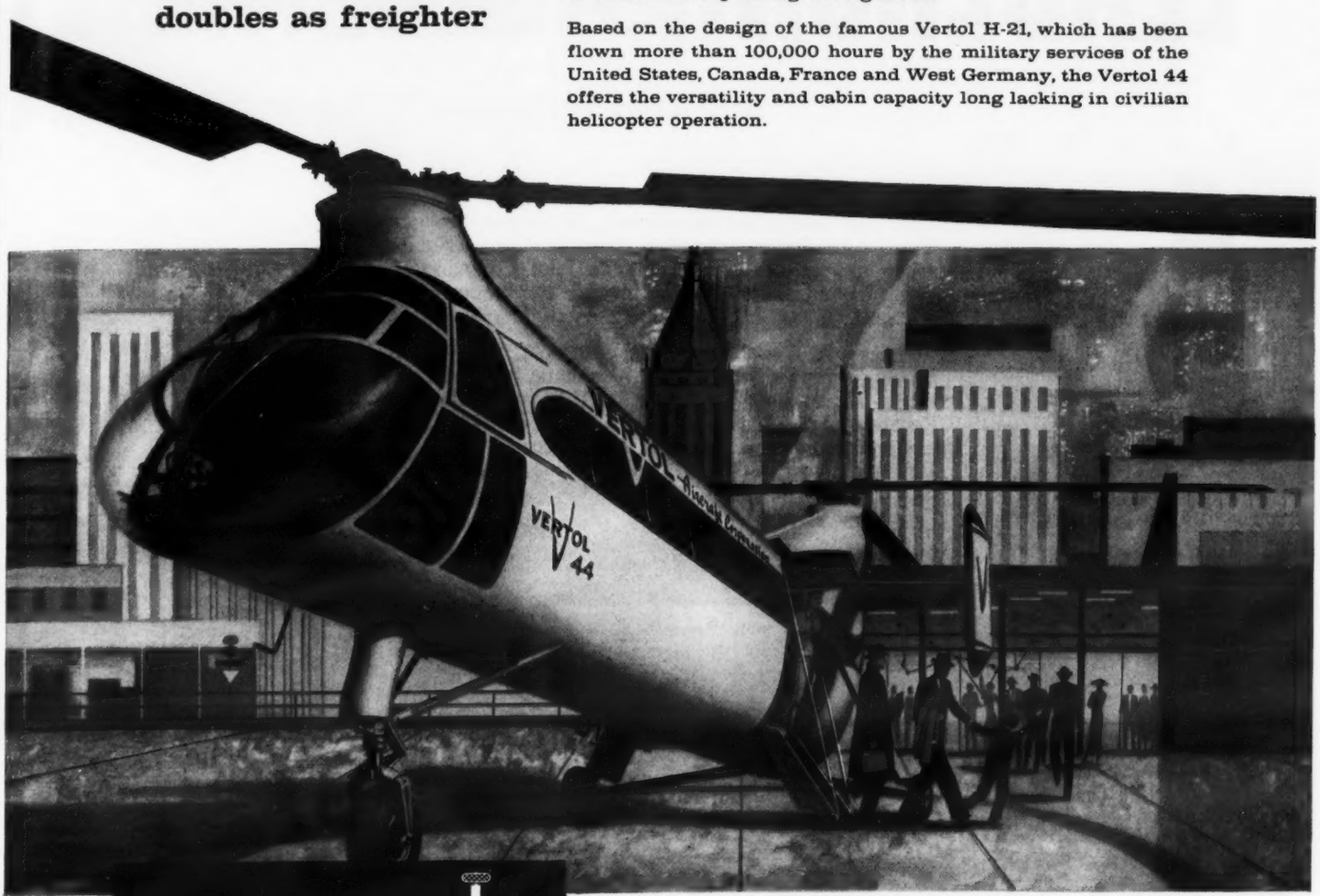
AUSTRALIA . . . Minnesota Mining and Manufacturing (Australia) Pty., Limited, St. Marys, New South Wales

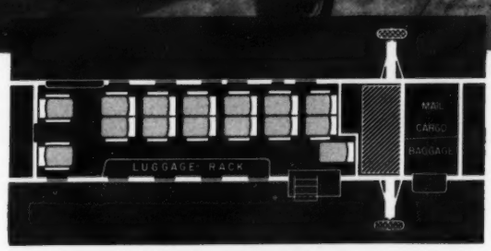
CANADA . . . Minnesota Mining and Manufacturing of Canada, Ltd., P.O. 757, London, Ontario

New Vertol helicopter seats 19 passengers, doubles as freighter

For the first time, a large capacity helicopter, the Vertol 44, is available to commercial operators. And it comes with a selection of interiors suited for airline operation, executive transportation, or combination passenger-freight use.

Based on the design of the famous Vertol H-21, which has been flown more than 100,000 hours by the military services of the United States, Canada, France and West Germany, the Vertol 44 offers the versatility and cabin capacity long lacking in civilian helicopter operation.





Cabin layout show 15 luxury seats in Vertol 44 airliner version.

Visit Vertol at the Salon Aeronautique. See the Model 44 in flight and on display.

Check these new Vertol 44 features:

- Highest useful load, greatest seating capacity, lowest seat-mile cost in commercial helicopter field. Tandem rotor design allows passengers to sit any place in cabin and eliminates balance problem in placement of cargo.
- Internal capacity, approximately 600 cu. ft. of freight in cargo version. Can carry 2½ tons on external cargo sling.
- Capacity for 19 passengers, using high density seating arrangement. Luxury seats for 15 in airline version with large window next to every seat. Seats fold away for conversion in minutes to cargo configuration.
- Two large doors permit quick and easy loading and unloading; rear door folds down with integral stairway.
- Better high altitude performance with two-speed engine supercharger.

For detailed information on the Vertol 44 write to:
Customer Relations Manager

VERTOL Aircraft Corporation

MORTON, PENNSYLVANIA

LEADERSHIP: automatic fl

Aer Lingus . . . another airline se

Collins Automatic Pilot controls the aircraft in all modes of flight with unequalled smoothness. Its advanced features improve steering interpretation, dependability, and control. As an integral part of the Automatic Pilot, Collins Integrated Flight System presents the pilot with a continuous picture of flight attitude and navigational situation.

The new Aer Lingus fleet of Fokker F-27 "Friendships" is being equipped with Collins Automatic Pilot; Integrated Flight System; ADF, VHF, VOR/ILS and Marker Beacon Receivers; HF Transceiver, and Compass System. Collins equipment is also on order for Aer Lingus Vickers Viscount 800's.

21st
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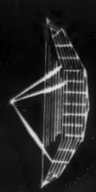
IRISH AIR LINES

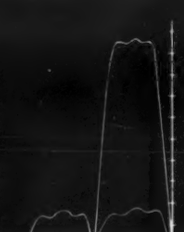
COLLINS IN GROUND COMMUNICATION

Collins engineers, designs and supplies the equipment, installs, and puts into operation integrated point-to-point communication systems of any scope. The Collins system engineering staff is backed by the finest equipment in the world, whether standard MF, HF or VHF, Transhorizon "scatter," microwave relay and multiplex or single sideband HF. Typical of Collins communication progress is "Kineplex" — a high speed data transmission system doubling communication capacity.



COLLINS IN AMATEUR RADIO

In the early 1930's Collins set the standard in Amateur radio and, through continuous design and development, has raised this standard to its present single sideband station — the most honored and prized in the Amateur fraternity. This station is the top performing rig on the air with its kilowatt KWS-1 transmitter and highly selective 75A-4 receiver. Many of the leaders in the electronics industry became acquainted with Collins through the Company's superior Amateur equipment.



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COLLINS IN BROADCAST

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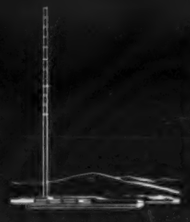

COLLINS IN COMPONENTS AND TEST EQUIPMENT

The degree of precision and reliability of Collins products requires development by Collins engineering of components such as Autotunes and Autopositioners, Mechanical Filters, oscillators, heat reducing tube shields and ferrites. These developments and other high quality components are sold by a Collins subsidiary, Communication Accessories Company of Hickman Mills, Missouri. The same principles of accuracy and reliability apply to Collins test equipment, built especially for Collins but adaptable to testing other equipment types.

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Some typical applications:

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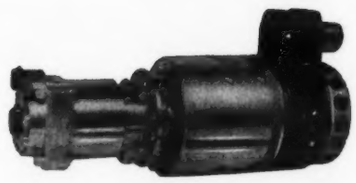

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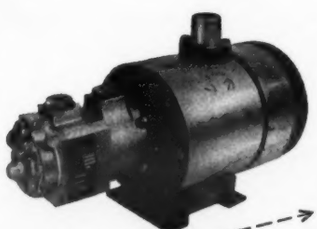
under a pressure of 3,000 p.s.i.



Electric pump
Delivery 0.9 gals./min. at 6,850 r.p.m.
under a pressure of 3,000 p.s.i. (Fouga 170 S)

Self-regulating pump
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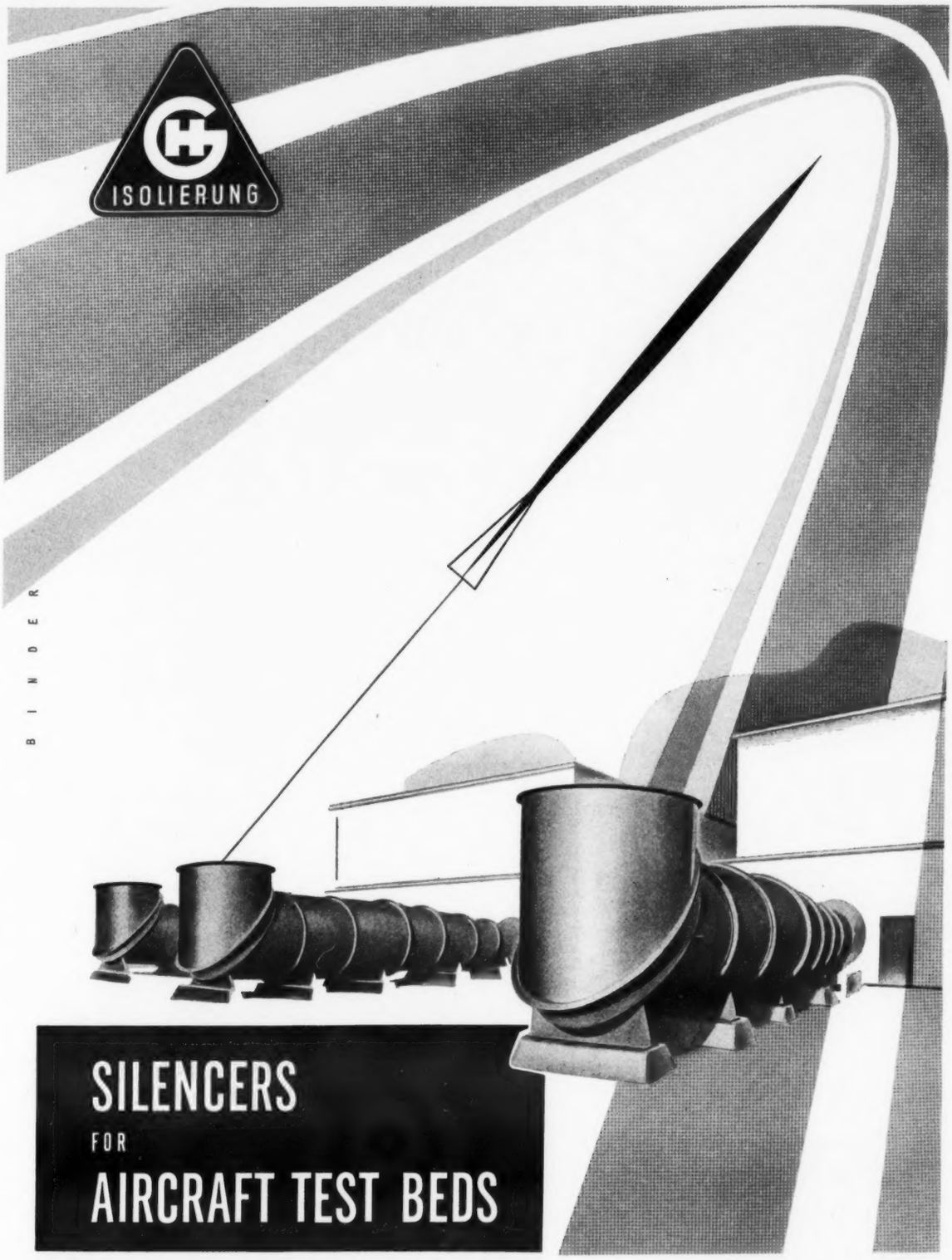

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for short, medium and long range airliners

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Rolls-Royce gas turbines have already flown more than 2,000,000 hours on scheduled airline service

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America's Representatives

The American aircraft industry, today the largest employer in the United States, with a labour force of roughly 800,000, will be represented at the 22nd Paris Aircraft Show by five of its biggest aircraft manufacturers, three engine producers and two major companies from the equipment industry. The ten firms concerned are as follows:*

A. Aircraft manufacturers

1. Boeing Airplane Company
2. Convair Division, General Dynamics Corporation
3. North American Aviation, Inc.
4. Republic Aviation Corporation
5. Sikorsky Division, United Aircraft Corporation

B. Engine manufacturers

6. Aircraft Gas Turbine Division, General Electric Company
7. Curtiss-Wright Corporation
8. Pratt & Whitney Aircraft Division, United Aircraft Corporation

C. Equipment manufacturers

9. Bendix Aviation Corporation
10. Hamilton-Standard Division, United Aircraft Corporation.

Exactly what these companies plan to exhibit at Paris has not been announced as these lines go to print. The following must therefore be restricted to an overall account of the American exhibitors' plant, number of employees and production programmes. A detailed description of what they bring to Paris, with particular reference to any new products, will be given in the July issue of *Interavia*.

By way of introduction, a few selected figures will illustrate what the *U.S. aircraft industry as a whole* turns out today and what it has been capable of during critical periods in American history.

I. Output during the 1956 calendar year

(Source, year-end report by Admiral DeWitt C. Ramsey, President of the Aircraft Industries Association.)

	Aircraft	*Engines*
Military	approx. 7,000	approx. 12,500
Civil	approx. 7,500	approx. 12,000
Total	*approx. 14,500*	*approx. 24,500*

The sales volume of aircraft, engines, propellers and spares reached the handsome total of $8,600,000,000; the total spent on guided missiles can be estimated at $1,000,000,000, excluding development costs.

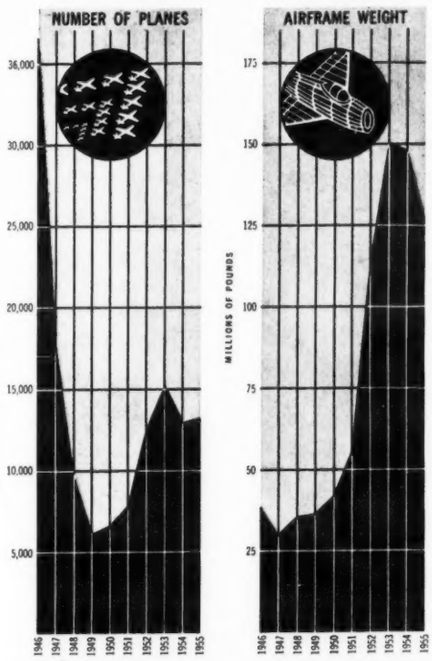
II. Aircraft production (outstanding years) from 1914 to 1953

(Source A.I.A.'s "Aviation Facts and Figures, 1956".)

World War I period				
Year	*1914*	*1917*	*1918*	*1919*
Military	15	2,013	13,991	682
Civil	34	135	29	98
Total	*49*	*2,148*	*14,020*	*780*
World War II period				
Year	*1939*	*1944*	*1945*	*1946*
Military	2,195	96,318	47,714	1,669
Civil	3,661	0	2,047	35,001
Total	*5,856*	*96,318*	*49,761*	*36,670*
Korean War period				
Year	*1950*	*1951*	*1952*	*1953*
Military	3,000(e)	5,400(e)	9,000(e)	11,000 (e)
Civil	3,520	2,477	3,509	4,134
Total	*6,520(e)*	*7,877(e)*	*12,509(e)*	*15,134(e)*

(e) Estimate

Total American aircraft production during the past ten years is also indicated in the accompanying diagram.



American aircraft production from 1946 to 1955. Left, the number of aircraft; right, the airframe weight (excluding engines and equipment) in millions of pounds.

Example of an American aircraft plant: the final assembly hangar for Boeing B-52 *Stratofortress* intercontinental bombers at Wichita, Kansas.

III. Engine production (outstanding years) from 1939 to 1953

(Source, A.I.A.'s "Aircraft Year Book 1956".)

Year	*1939*	*1944*	*1946*	*1953*
Military	...	256,911	2,585	34,500 (e)
Civil	...	...	40,822	6,647
Total	*11,177*	*257,000(e)*	*43,407*	*41,147(e)*

The industry paid out more than $4,400,000,000 in salaries and wages during 1956, and its order backlog on October 1st, 1956 was $18,363,000,000, of which sum $12,882,000,000 was for military aircraft. By the end of the year new orders and options were on hand for roughly 600 turbine-powered commercial transports, to a total value of more than $2,000,000,000.

1. Boeing Airplane Company

With plants at Seattle and Renton, Washington, and Wichita, Kansas, Boeing employs nearly 73,000 personnel and holds unfilled orders to a value of roughly $2,230,000,000. In 1956 the 888th (and last) Boeing KC-97 tanker/transport was delivered to the U.S. Air Force, as was also the last of around 1,200 B-47 *Stratojet* six-jet bombers and long-range reconnaissance aircraft. In addition, some 150 B-52 *Stratofortress* eight-jet bombers have so far been delivered, and the first KC-135 tanker/transport has begun flight testing. By mid-October 1956 the prototype of the Boeing 707 jet commercial transport had completed more than 600 flying hours. At the same time Boeing announced the receipt of orders and letters of intent for 134 aircraft of this type, the first of which are scheduled for delivery to P.A.A. at the end of 1958. Boeing also produces type 502 propeller turbines (so far more than 500) and is developing a long-range surface-to-air missile (IM-99 *Bomarc*) for the U.S. Air Force. During the first forty years of the company's history, to July 15th, 1956, a total of 23,450 aircraft of more than 200 different types were built by Boeing.

2. Convair Division, General Dynamics Corporation

Convair has production plants at San Diego and Pomona, California, and at Fort Worth and Daingerfield, Texas. Present labour force is roughly 68,000 strong, and the production programme covers the F-102A and F-106A all-weather supersonic fighters, the B-58 *Hustler* supersonic bomber, the R3Y *Tradewind* transport and tanker flying boat, the Convair 440 *Metropolitan* and Convair 880 (four jets) commercial transports, and the *Atlas* I.B.C.M. and *Terrier* surface-to-air rocket. Convair is also credited with planning to build the first atomic-powered aircraft. Preparatory

* In addition to the ten companies exhibiting in Paris, the U.S. aircraft industry includes 9 major aircraft manufacturers (Bell, Chance Vought, Douglas, Fairchild, Grumman, Lockheed, McDonnell, Martin, Northrop), 16 medium aircraft manufacturers, 6 large and 14 smaller engine manufacturers and several hundred parts and equipment firms.

tests were made in 1955 and 1956 with a surplus B-36 long-range bomber, in order to study the problems of shielding and measure the radio-active heating of the airframe. The bomber carried a light-weight atomic reactor built by Convair, but flew on its ordinary engines.

3. North American Aviation, Inc.

With a payroll of some 70,000, North American Aviation maintains production plants at Los Angeles, California, and Columbus, Ohio, with subsidiary plants at Fresno, Downey and Canoga Park, California. The two latter plants and the company's Santa Susana test centre in Southern California, however, are engaged chiefly in the fields of remote control and guidance (Autonetics Division) and rocket development (Rocketdyne Division). The main plant, in Los Angeles, is at present producing chiefly F-100 *Super Sabre* fighters and fighter-bombers (American production of the F-86 was phased out in December 1956) while the Columbus Division manufactures FJ-3 and FJ-4 *Fury* carrier-based jet fighters, and T-28B and C trainers (also F-100s). Outside the United States, North American supervises the licence production of the F-86 (in Australia, Canada, Italy and Japan) and the repair of these aircraft in Spain. In the missile field, the SM-64 *Navaho* (with ramjets plus rocket motor) is undergoing tests, and rocket power plants for the SM-64, the *Thor* I.R.B.M. and the *Atlas* and *Titan* I.C.B.M.s are being developed and produced. Finally, mention should be made of the company's—or more exactly its Atomics International Division—activities in connection with the civil applications of atomic energy.

4. Republic Aviation Corporation

Manufacturers of the F-84F *Thunderstreak* fighter-bomber and RF-84F *Thunderflash* armed reconnaissance aircraft, both of which are used in large numbers by the N.A.T.O. air forces, Republic, of Farmingdale, Long Island, New York, has subsidiaries in France (Republic Aviation Corporation of France) and in Switzerland (Republic Aviation International S.A.), and licence agreements with Weser (Germany) and Aerfer (Italy). Last year a new fighter-bomber and armed reconnaissance aircraft was delivered to the U.S. Air Force, with the designation F-105 (or RF-105). Finally, Republic is building the *Terrapin* two-stage research rocket, a joint development by Republic and the University of Maryland, and is working on a number of electronic guidance systems.

5. Sikorsky Division, United Aircraft Corporation

Sikorsky employs roughly 10,000 personnel at its two plants at Stratford and Bridgeport, Connecticut, at the former of which the S-55 (single-engine) and S-56 (twin-engine) helicopters are in large-scale production, and at the latter the single-engine S-58. In the Summer of 1956 the 1,000th S-55, a military version, rolled off the production line. About the same time a military S-58 set up a new F.A.I. record with an average speed of 123 knots over a distance of 100 km. The S-58 is used by the Belgian airline Sabena on its scheduled service between Brussels and Paris and carries up to ten passengers.

6. Aircraft Gas Turbine Division, General Electric Company

Part of the world's largest industrial concern (with realizable assets of $829,000,000 at the end of 1956), General Electric's Gas Turbine Division, of Evendale, Ohio, today employs around 14,000 workers. Main production items are the J79 super-powerful reheat jet (for the Lockheed F-104A *Starfighter* and Convair B-58 *Hustler*) and CJ 805 civil versions of the engine (for the Convair 880), as well as the J85 medium-power jet engine, the T58 propeller turbine and the X-405 liquid-propellant rocket motor for the first stage of the *Vanguard* satellite carrier (13 ordered). Two other branches of General Electric also produce components for aircraft engines, namely the Aircraft Accessory Turbine Department (West Lynn, Massachusetts) and the Aircraft Nuclear Propulsion Department. The Missile and Ordnance Systems Department (Philadelphia, Pennsylvania) builds fuselage noses for strategic missiles, the Aircraft Products Department (Schenectady, New York) produces guns (the *Vulcan* 20-mm cannon) and rear gunnery posts for bombers, and the Instrument Department (West Lynn, Massachusetts) is working on new compass systems and aircraft instruments in general.

Example of an American engine plant: the East Hartford, Connecticut, plant of Pratt & Whitney Aircraft Division, United Aircraft Corporation.

7. Curtiss-Wright Corporation

This parent organization for the development and production of aircraft, marine, automotive and industrial engines, propellers, plastics, telecommunications equipment and electronic components maintains no fewer than seven production divisions throughout the United States, as well as seven research and sales divisions. It also has two foreign subsidiaries, Curtiss-Wright of Canada Ltd. and Curtiss-Wright Europa N.V., Amsterdam. The most important production division, Wright Aeronautical Division, is located at Wood Ridge, New Jersey, and manufactures J65 jets (under Armstrong-Siddeley licence) for military aircraft and R-3350 *Turbo-Compound* engines for the airlines.

8. Pratt & Whitney Aircraft Division, United Aircraft Corporation

Pratt & Whitney's main plant at East Hartford, Connecticut *(picture)* and twelve subsidiary plants at various localities employ a total of over 40,000 workers, primarily on the production of J57 and J75 jets (including the JT3 and JT4 civil versions), and T57 and T34 propeller turbines. The proven R-2800 *Double Wasp* two-row radial engines are also in production for civil and military use, as well as the older J48 radial-compressor jet. Finally, Pratt & Whitney also maintains —jointly with the U.S. Air Force—a nuclear research laboratory for aircraft power plants, the Connecticut Aircraft Nuclear Engine Laboratory (Canel) at Middletown.

9. Bendix Aviation Corporation

The Bendix Aviation Corporation with 25 divisions and eight subsidiaries (including six outside the United States), is believed to be the world's biggest equipment firm. It offers both civil and military aviation a full range of several hundred equipment items, including instruments of all kinds, fuel metering systems and ignition systems for piston engines or gas turbines, storm-warning radar, navigation and telecommunications equipment, anti-skid wheels and brakes, generators, motors and transformers, radio tubes and transistors . . . in brief everything that makes a naked airframe into an operational aircraft. The corporation's total employment figures are not known; realizable assets at the end of 1956 were given as $220,000,000. The concern also has licence agreements with half the countries of the world.

10. Hamilton Standard Division, United Aircraft Corporation

With a labour force of around 10,000 and main plant at Windsor Locks, Connecticut, subsidiary plant at St. Petersburg, Florida, and its Aero-Pneumatics Division (formerly part of Pacific Airmotive Corporation), the Division produces mainly variable pitch propellers for piston engines (the *Hydromatic* family) and turboprops *(Turbo-Hydromatic)*, including a new type of hollow-blade aluminium alloy propeller for the Lockheed L-1649A *Starliner* and *Electra*. In addition various types of accessory parts for air conditioning and pressurization systems, as well as hydraulic pumps and pneumatic engine starters are also in production, all of them developed and operationally tested by Hamilton Standard over a number of years.

Old and New Exhibitors from West and East Europe

Not only the number of exhibiting firms but also the list of participating countries grows from one Show to the next. For example, three of the six national aircraft industries discussed below will be appearing at Paris virtually for the first time.

In view of the capacity of its aircraft industry, it may seem surprising that, apart from modest feelers by Flygmotor and STAL, Sweden should hitherto have remained aloof. Even this year Sweden's participation will be relatively small, a circumstance which must most probably be attributed to military security considerations. Basically the Swedish industry would be entirely capable of appearing in force with a full range of mainly military aircraft, in line with its impressive production programme. It will in fact present some of its latest products in the field of airborne and ground equipment.

Understandably, the young German industry cannot yet have any very extensive catalogue of original designs to offer, though it may well be that visitors to the next Show two years hence should be prepared for certain surprises in this direction.

Turning to Eastern Europe, it is the contributions of Poland and Czechoslovakia that will draw the greatest attention. Both countries have been making persistent efforts during the past few years to make a place for themselves on the international market. The Czechoslovak aircraft industry in particular, reverting to its pre-war tradition, will present a surprisingly large number of new products and for the first time enter into competition with Western designs in the flying displays.

Belgium

The Belgian contribution to the 22nd Paris Air Show can be described fundamentally as the "mixture as before", though it should not be forgotten that the products of this small but active industry attracted well-deserved attention at the 1955 Show. The main exhibitor again this year will be GEBECOMA (Groupement Belge des Constructeurs de Matériel Aéronautique), on whose large joint stand the following companies will be represented:

- Ateliers de Constructions Electriques de Charleroi (ACEC), Charleroi.
- Avions Fairey S. A., Gosselies.
- Fabrique Nationale d'Armes de Guerre (FN), Herstal.

  Société Anonyme Belge des Constructions Aéronautiques (SABCA), Brussels.
- Stampe & Renard S.A., Brussels.

The SABCA and Avions Fairey exhibits will be devoted primarily to the licence production of the Hawker *Hunter* fighter, of which a total of 128 has been ordered. SABCA also produces parts for the SO. 4050 *Vautour* twin-jet combat aircraft, and, under an agreement concluded with Fokker at the end of last year, will supply the Dutch company with tooling and equipment.—Stampe & Renard are bringing their S. R. 7 *Monitor* elementary trainer to Paris; this aircraft is being built in relatively small numbers for the Belgian Air Force.—Finally, Fabrique Nationale d'Armes de Guerre is showing examples of its engine and weapons production, with special emphasis on its licence version of the R. R. *Avon* (for the *Hunter*) and its 40-mm and 57-mm anti-aircraft guns.

Stampe & Renard S. R. 7 B *Monitor* elementary trainer, a two-seater of mixed construction and 180 h. p. Blackburn *Bombardier 702* engine.

Czechoslovakia

Czechoslovakia's State-owned aircraft and engine manufacturers will appear in Paris with a relatively large collection of aircraft, engines, airborne equipment, etc. The large number of exhibits once again confirms that Czechoslovakia has built up an industry that is proficient in many branches of aviation and which is coming to Paris to compete for international sales. Omnipol, the State Sales Organization in Prague, is showing the following aircraft on the ground or in flight:

The L. 60 *Brigadyr* three-seater built by the Czechoslovak State Automobile and Aircraft Works, can be used for agricultural purposes, aerial mapping, glider towing and other similar duties.

Avia 14 is the name of the Czech licence version of the Il-14, which has accommodation for 22 passengers. Radio navigation aids are designed to permit operations on international routes.

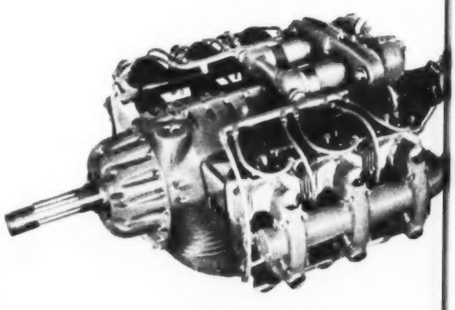
This single-seat version of the well-known Zlin *Trener* has already appeared at several Western European sports flying events and is used by Czech pilots chiefly for aerobatic displays.

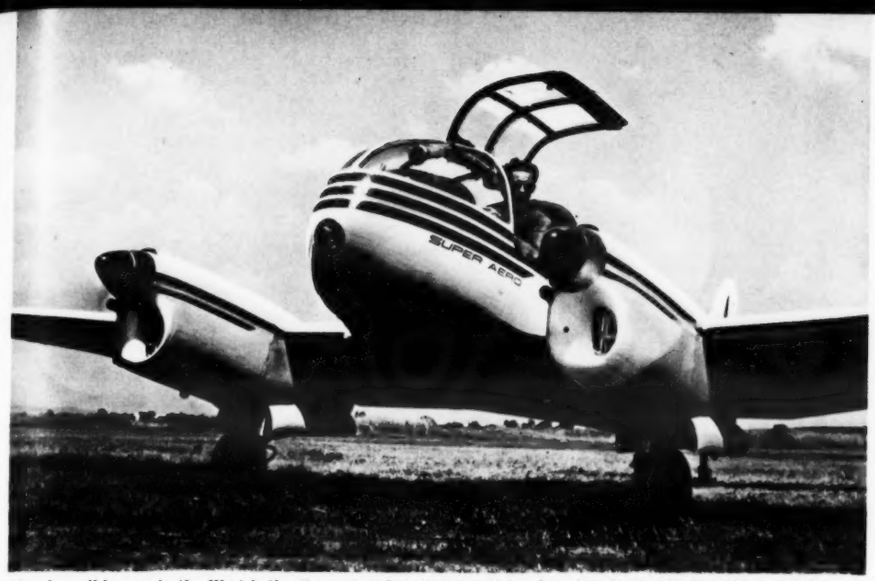
- L. 60 *Brigadyr* three-seat multi-purpose aircraft (one 220 h. p. Praga *Doris B.*).
- *Super Aero* touring four-seater (two 105 h. p. Walter *Minor 4-IIIs*).
- Zlin Z. 226 *Trener* two-seat trainer (one 160 h. p. Walter *Minor 6-III*).
- L. 40 *Meta Sokol* three-seat sports and touring aircraft (one 105 h. p. Walter *Minor 4-III*).
- HC. 2 *Heli-Baby* two-seat helicopter (one 83 h. p. Praga DH).
- Avia 14 commercial transport for 22 passengers (licence version of the Russian Il-14 with two 1,900 h. p. M-82T engines).

Omnipol's stand will also show the Walter *Minor 4-III*, Praga M 208 *Doris C* and M 332 engines, as well as propellers, airborne instruments and test equipment of various kinds.—

L. 40 *Meta Sokol* sports and touring three-seater, a new design by the Czech Automobile and Aircraft Works, with 105 h. p. Walter *Minor 4-III*. The low-cost all-metal low-wing monoplane has a "reversed" tricycle undercarriage and a cruising speed of approx. 108 knots.

The Praga *Doris B* air-cooled flat-six engine was exhibited at the 1955 Paris Show. It has a power of 220 h. p. for a dry weight of 435 lbs. (excluding accessories, radio interference suppressor and fittings).





Already well-known in the West is the *Super Aero* four-to-five-seat touring aircraft (two Walter *Minor 4-IIIs*).

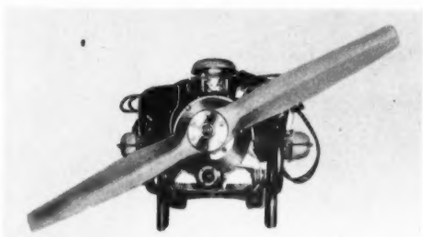
Another new Czech design is the HC. 2 *Heli-Baby* helicopter with Praga DH flat-four engine and three-blade rotor.

New designs for most Western visitors will be above all the L. 60 *Brigadyr* multi-purpose aircraft, the L. 40 *Meta Sokol* sports and touring aircraft and the HC. 2 *Heli-Baby* helicopter. The *Brigadyr* is suitable for either agricultural duties or communications and ambulance services. Alternatively it can be used as a glider tug, for towing advertising banners, for photographic survey work, etc. An undisclosed number of these aircraft has been ordered by the Argentine Air Force. Max. speed 102 knots, stalling speed 30 knots, take-off distance to clear a 50-ft. obstruction roughly 740 ft.—The L. 40 *Meta Sokol*, an all-metal low-wing monoplane with retractable three-wheel undercarriage of unusual design (the long-legged rear wheel is hinged immediately behind the wing), has a top speed of 122 knots and is relatively low-priced (price in Germany DM 53,900).—The HC. 2 *Heli-Baby* helicopter has, according to Czech sources, been developed by an unnamed group of engineers over the past ten years and is of pleasing design and light construction. Empty weight with 83 h. p. Praga DH engine approx. 835 lbs. A later version, the HC. 102 with 100 h. p. engine, is also available.

Germany

This year, for the first time since the war, a German aircraft will be taking part in the flying display. Dornier (of Friedrichshafen, Neuaubing and Oberpfaffenhofen) is sending the Do 27 multi-purpose military aircraft, which has been ordered in large numbers (428 aircraft) for the German forces and has recently also been offered for sale in a civil version. With a 260 h. p. Lycoming GO-480 engine, the Do 27 reaches a max. speed of 143 knots and combines good cruise performance with imposing take-off and low-speed qualities. Take-off speed 34 knots; distance to clear a 50-ft. obstruction roughly 475 ft.

A new-comer to the ranks of aircraft engine manufacturers is Porsche-Automobilwerke, of Stuttgart. The company has developed its well-known air-cooled sports car engine into a robust power unit for light aircraft, with a take-off rating of 65 h. p. and a life of 600 hours between overhauls. The new engine—Porsche 678/1—has a double downdraft carburettor (hence is fully aerobatic) and weighs 230 lbs. complete with starter, heater, exhaust silencer, radio interference suppressor and cowling, but without propeller. In addition, a simplified, lighter version with a take-off rating of 50 h. p. and weighing only 155 lbs. is also offered.—Finally, a number of companies from the German accessories industry are expected to exhibit at Le Bourget, either direct or through their French agents. They will include Stiebel.



Porsche 678/1 air-cooled flat-four engine of 65 h. p. take-off rating.

Do 27 multi-purpose military aircraft, future standard model for the German Air Force. A civil version will be shown in Paris.

Netherlands

Having completed its post-war reconstruction and an extensive modernization programme, the Dutch aircraft industry is today once more running at full steam. More than 6,000 workers are employed by the two major companies, Fokker and Aviolanda, and Fokker's three main plants alone cover an area of more than 1,130,000 sq. ft. Production contracts and licence agreements for trainers (Fokker S. 11, S. 12, S. 14) laid the foundations for development of the Fokker F. 27 *Friendship* twin-turboprop commercial transport, which is also to be built by Fairchild Engine and Airplane Corporation in the United States. The success of the flight testing by the two *Friendship* prototypes (total flying time to date more than 800 hours) has led to a rush of orders from throughout the world. So far Fokker itself has received orders for 29 aircraft (plus options on another 17), and Fairchild 31 firm orders plus 29 options. Some of the aircraft to

One of the highlights of the Paris flying displays: the Fokker F. 27 *Friendship* short and medium stage transport with two Rolls-Royce *Dart* propeller turbines.

be supplied will be specially equipped as luxury executive transports, flying laboratories for testing radio navigation systems, etc.—The second *Friendship* prototype (PH-NVF), with complete cabin equipment, will participate in the flying display, while Fokker's stand inside the exhibition building will show the Fokker-Eckold shaping machine.

Other Dutch aircraft or equipment companies, such as Aviolanda N. V. or Hollandse Signaalapparaten N. V., are not expected to appear in Paris, as they are engaged primarily on production orders for the N.A.T.O. forces, and their products thus fall under security regulations. The Philips concern, however, will be represented by its French subsidiary, Philips S. A., Paris.

A Polish newcomer to the Paris Show is the TS. 8 *Bies* piston-engine trainer, designed by Tadeusz Soltyk (7-cylinder WN-3 radial engine).

Poland

Like the Czech industry, the Polish State-owned company Polskie Zaklady Lotnicze (PZL) is represented by a joint sales organization (Motoimport), which is directly subordinate to the State Foreign Trade Centre in Warsaw. Exhibits include the TS. 8 *Bies* two-seat trainer, designed by Tadeusz Soltyk and powered by a WN-3 seven-cylinder radial engine of 320 h. p. take-off rating. The all-metal low-wing monoplane has a top speed of approx. 170 knots, is fully aerobatic and certificated for instrument training. Motoimport may also show gliders and ground equipment.

Sweden

As already mentioned, Swedish aircraft manufacturers' contribution to the Show is greatly limited by security regulations, since this extremely active and up-to-date industry is working chiefly on military orders. Instead, however, the following figures for Svenska Aeroplan A. B. (Saab) will give some idea of the capacity of Sweden's largest manufacturer in the aeronautical field. Roughly 1,000 engineers are at present working on the development of new aircraft and equipment. Total staff has risen from 4,000 (1,500 engineering and office staff and 2,500 workers) in 1950 to around 7,000 (3,000 and 4,000 respectively) at the present time, making Saab the biggest privately-owned aircraft company in Continental Europe. The four main and three subsidiary production plants cover a total area of about 32,000,000 sq. ft., and a large part of the installations are in bomb-proof underground shelters.

Pride of place in Sweden's list of aircraft exports is held by the Saab 91B *Safir* elementary training and touring aircraft. Twenty-five of the Saab 91B-2 version shown here are destined for the Norwegian Air Force.

The latest addition to Saab's production programme is the J 35 *Draken* supersonic all-weather fighter with double-delta wing and a top speed corresponding to Mach 1.5. Extensive radar equipment, together with automatic sighting and fire control systems, make the rocket-carrying *Draken* into one of the most up-to-date of fighters, whose combat performance lags little if any behind the latest products of the bigger Western Powers.

Saab is also energetically tackling the design of new equipment for both aircraft and missiles, with one eye firmly fixed on the export market. It has already brought out, for example, an automatic hit indicator, designated BT-13 (cf. *Interavia* No 2, 1956, p. 122), which is already in use for gunnery practice in several air forces. Other items in production include an ultra-light automatic pilot for missiles and a toss bomb computer designated BT-9. Saab's wide activities in the field of airborne and ground equipment are illustrated on a very instructive stand inside the exhibition building.

Air Transport Fixes and Headings

Cheap fares . . . + 5%
From tourist class to rate increases

Had the birthday celebrations been organized a little too soon? At the end of March 1957 the International Air Transport Association had announced that the fifth anniversary of the introduction of reduced fare tourist services on the North Atlantic would be commemorated by a number of special events on May 1st. For example, I.A.T.A. Director-General Sir William P. Hildred would make a speech at a National Aeronautic Association dinner in Washington. And I.A.T.A. went even further. In preparation for the anniversary, it published a booklet extolling the benefits which the reduced air fares had brought the economies of the Atlantic nations.

A few days later came a dampening of enthusiasms —in the shape of a laconic telegram from Paris: a hastily convened special conference of the fourteen I.A.T.A. airlines engaged in the North Atlantic traffic had unanimously decided to seek authorization from their respective governments for a five-percent increase in all Atlantic fares. Proposed date for the new higher rates was May 1st... the very day on which the birthday celebrations were to have been held.

Price increases seldom come unaccompanied. A second report announced, on behalf of the European airlines, that the five-percent rise would also be applied to most of the European air services. The Spaniards even went a long step further. According to an Agence France Presse message of April 4th, they had decided to raise all domestic railway and air fares by no less than 35%, and had clearly stated that foreign airlines operating to Spain would also have to conform to the new rates for the Spanish portions of their services. Finally, the New World made its own contribution to this fares symphony when an Air Transport Association of America bulletin announced that U.S. domestic airlines were endeavouring to persuade the public that a six-percent increase in domestic air fares was long overdue.

*

The steadily growing importance of transport costs in modern economic life was thrown suddenly into strong relief a few weeks ago by reports from Chile, where the announcement of an apparently harmless increase in fares had been the final spark which touched off a violent uprising in the capital, Santiago de Chile. Unlike the Chileans, the travelling public of the United States and Europe would probably be less exuberant in their reactions and would be unlikely to resort to brute force in order to demonstrate their disapproval of fare increases. Nevertheless, a five to six percent rise will leave no air traveller cold. In fact, he may well ask himself if all the talk of fare reductions has not taken a somewhat queer turn.

It would be an injustice to the airlines to describe the present rate corrections as an undisguised increase in the whole rate structure of world air transport. Any suggestion that the airlines regretted the introduction of the tourist class and were now about to counteract its effects to some degree by their recent decisions would be wide of the mark.

Admittedly it would be easy to jump to this conclusion, since there has in recent months been outspoken criticism of the tourist rates. To put it briefly, critics have objected that, though the cheap fares policy has brought substantial benefits to the economies of the countries concerned, in particular by increasing the flow of foreign currency, it has cut airline profits to the bone.

The sharpest expression of this criticism was formulated by Sir William Hildred in September 1956 in his report to the I.A.T.A. Annual General Meeting in Edinburgh. Speaking of "Fares and wishful thinking" he asked bitterly: "Why not go the whole hog, let everybody fly free and let the airlines be entirely financed by government funds?"

As already stated, it would be misleading to describe the latest rate corrections as a departure from I.A.T.A. price-cutting policy. In reality the new decisions represent a—perhaps temporary—emergency measure. They are an attempt to compensate to some extent for the inflationary tendencies in the United States and Europe and to avert the financial débacle which has come unpleasantly close to the airlines.

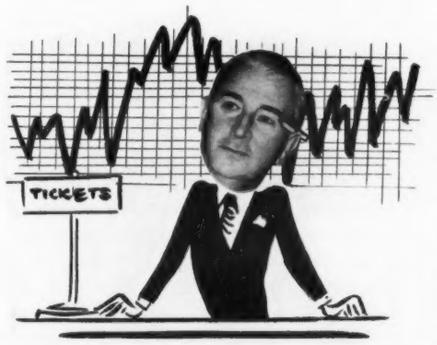
During the twelve months since the last I.A.T.A. rates conference, in May 1956, practically all costs in air transport have risen sharply. Salaries have increased by an average of 8%, the price of spares by 20 to 30%. The most serious rise has been in the cost of fuel, which, as is known, accounts for roughly one fifth of total operating costs in air transport. Since January this year fuel prices have climbed more than 10%—thanks in part to Nasser—and one of the major airlines expects to have to pay at least three million dollars more for this one item during 1957.

It might be suggested that, in order to attract greater traffic volume, the airlines should pay these price increases out of their own pockets, under the motto "pay up and shut up". But this, after the events of the past ten years, they are incapable of doing. The air transport industry, whose rates have remained virtually stable under government pressure, while general prices have gone on rising, today claims to be working on a 1.1% profit margin. Here a comparison between cost of living and air fares in the United States, recently published by the Air Transport Association, reveals some interesting figures.

Movements in U.S. cost of living and domestic air fares

	Cost of living index	Air transport revenue per passenger-mile
1938	100.0	100.0
1946	138.3	86.8
1947	158.4	94.7
1948	170.5	108.1
1949	168.8	108.1
1950	170.5	104.1
1951	184.1	105.1
1952	188.2	104.1
1953	189.7	102.1
1954	190.4	100.9
1955	189.9	100.0
1956	192.7	99.6

In other words, cost of living in 1956 was almost twice as high as before the war. The air traveller, however, today pays less for his flight than he did in 1938. Yet even in 1938 everybody needed clothing, food and shelter, while only few were sufficiently "daring" to travel by air.



I.A.T.A. Director General: Do you want cheaper or dearer travel? We have both in stock.

The U.S.—Dutch air transport agreement

When Dutch Under-Secretary van der Beugel climbed aboard the aircraft for Schiphol at Washington on the night of April 3rd, 1957, he must have felt that a load had been removed from his mind. After long-

drawn-out negotiations, which have been dragging along for practically four years—and which had been broken off as temporarily hopeless in August 1956—he finally had the air transport agreement between the Netherlands and the United Stafes, duly signed and sealed, in his briefcase.

Though not all of K.L.M.'s hopes have materialized, the company has at least been granted half of what it had asked for. The new agreement gives it the right to operate a direct service between New York and Curaçao (Dutch West Indies) and to call at Houston, Texas, on the Amsterdam–Montreal–Mexico City route. The long-coveted commercial landing rights at Los Angeles, however, were refused.

In their air transport negotiations with the United States the Dutch had bad luck from the start. The talks were handicapped by the U.S.-German agreement of July 1955 and by the U.S.-Scandinavian tussle over S.A.S.'s Arctic route between Europe and the United States, which had ended in provisional agreement in November 1954. Both agreements had left behind in American air transport and Congress circles the uncomfortable feeling that the United States had somehow been imposed upon. An investigating committee appointed by the Senate produced a report on April 30th, 1956 in which with a large majority it concluded that the agreement policy followed by the State Department and the C.A.B.was in direct conflict with American economic interests and would lead to the passenger traffic's being "sold out" to foreign countries which had no comparable rights to offer U.S. airlines. For example, S.A.S.'s authorization to operate to New York and Los Angeles had handed over to Scandinavia a passenger reservoir of 18,700,000 persons, while the three Scandinavian countries—Norway, Sweden and Denmark—could offer U.S. airlines a total population of only 14,900,000 persons. In other words, America was standing by while the Europeans cleaned it out.

It was only a few weeks after publication of this philippic that the Dutch appeared in Washington with their requests for new routes. In these circumstances it is not altogether surprising that they were sent home with a flea in their ear.

On their second attempt, however, the U.S. authorities have shown themselves more yielding.

The framework of the U.S.-Dutch agreement corresponds roughly to that of the 1946 Bermuda agreement between the United States and Britain, the model for almost all bilateral agreements since the war.

Apparently as compensation for the refusal of landing rights in Los Angeles, Article 12 of the agreement stipulates that "consultation between the competent authorities of both contracting parties may be requested at any time by either contracting party for the purpose of discussing the interpretation, application, or amendment of the agreement or schedules ...Such consultation shall begin within a period of sixty days from the date of receipt of the request by the Department of State of the United States or the Ministry of Foreign Affairs of the Kingdom of the Netherlands as the case may be".

The brush-off.

Oesterreichische Luftverkehr A.G. after five years' preparation

If the old belief that the stormier the engagement period, the better will be the marriage holds true, the newly-formed Austrian airline should be extremely happy. For it is the result of the union of two companies which, though neither had ever flown, had been loud and bitter rivals for years.

Originally it had looked as if air transport in Austria would run a smooth and unobstructed course. A report from Vienna on December 3rd, 1952 said tersely: "The Austrian Government plans to form an airline, to be equipped with British aircraft, as soon as the necessary authorization has been obtained from the Allies. The Austrian Civil Aviation Commission reports that the project has already been worked out in full detail..." But what actually happened was somewhat depressing.

Commercial aviation became a bone of contention between the bourgeois and the Socialist wings of the Austrian Coalition. The Conservatives (Austrian People's Party) set up the Studiengemeinschaft für Verkehrsluftfahrt, which eventually, after much hither and thither, emerged as Airaustria. The Socialists countered by forming a company known as Austrian Airways.

While Airaustria was backed financially and equipment-wise by K.L.M., Austrian Airways had secured the assistance of S.A.S. Airaustria planned to use British aircraft, while Austrian Airways was more interested in American equipment. In brief, the two resolved to play Tweedledum and Tweedledee, and apart from their skirmishings nothing more was heard about Austrian air services.

Finally, however, on April 4th, 1957 the two Coalition parties agreed on the formation of a single airline, Oesterreichische Luftverkehr AG., whose capital of 60,000,000 schillings (approx. $ 2,500,000) should be made up as follows: 42% from the existing Austrian shareholders in Airaustria, 28% from the shareholders in Austrian Airways, and 15% each from Scandinavian Airlines System and the Norwegian private airline Fred Olsens Flyselskap, Oslo. K.L.M. has withdrawn from the new company.

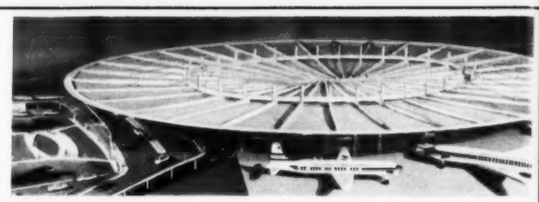
As regards flying equipment, Fred Olsen is to charter the Austrian airline four Vickers *Viscount* 779s. As trained personnel is already available—some of it trained by K.L.M.—services on the Vienna–Düsseldorf–Frankfurt–England/Scandinavia routes are expected to start shortly. A Vienna–Moscow service is also to be inaugurated this Summer. International ticket sales will be handled for the time being by S.A.S.

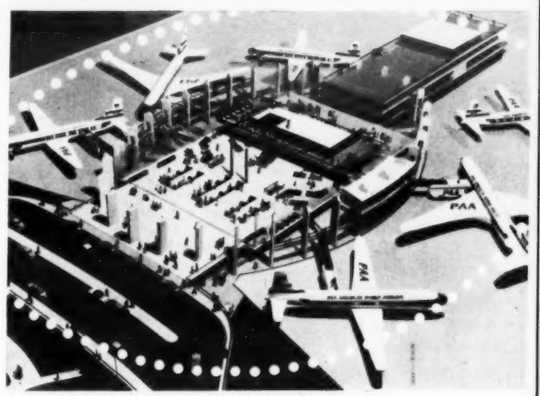
The Boards of the two original companies are to make known their views on this overall programme within the next few weeks. If all goes according to plan, there should in future be less talk and more action in Austrian air transport.

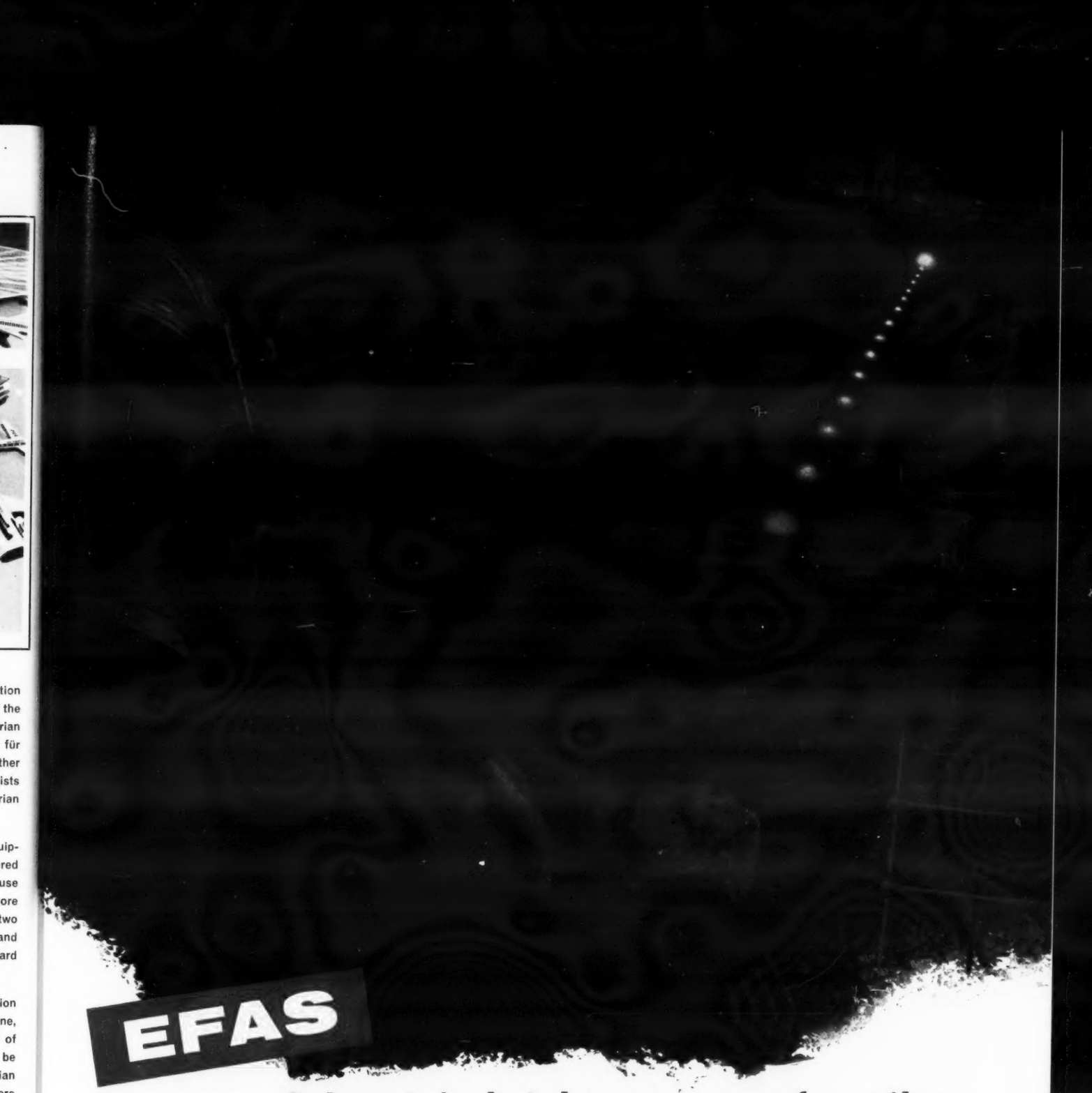
No More "Route Marches" at Airports

Many of the larger airports still expect air travellers to cover considerable distances on foot between the terminal building and their aircraft. For the athetically inclined this is no great hardship. But older people with heavy briefcases, for example, can well dispense with such performances, particularly in bad weather ... If, however, the Port of New York Authority's new building plans for Idlewild are copied in other parts of the world, future jet passengers will no longer have to be driven like sheep across the concrete.

At Idlewild airlines will have individual terminal buildings, with a drive-in for cars on the lower floor and passageways for passengers at aircraft floor level, the whole under cover. The first airline to plan such a building is P.A.A., whose terminal will cover an area of 176,000 square feet, cost $8,000,000 and be ready for occupation by the end of 1958. P.A.A.'s terminal, a model of which is shown in the accompanying pictures, will be able to handle a 160-passenger aircraft every 15 minutes. Above, the terminal with roof removed (the dotted line shows the size of the roof); right, model of completed terminal.







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TESTING A NEW PROPELLER TURBINE — Being flight tested in the nose of this modified Douglas C-124 is Pratt & Whitney Aircraft's T-57 propeller turbine. The T-57 engine is in the 15,000 hp-class. It combines power never before realized in a turbo-prop engine with many operating advantages for efficient flight of large, long-range aircraft.

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HELICOPTER TO THE CENTER OF PARIS — Twelve-passenger Sikorsky S-58 helicopters now fly passengers to the heart of Paris - the newest extension of SABENA Belgian World Airlines S-58 helicopter routes connecting Brussels with eleven cities in four countries. Versatile Sikorsky-built S-58s have been delivered in quantities to both the French Navy and Air Force. Sud Aviation is licensed to build additional S-58s for French military requirements.

PARIS AIR SHOW

A cordial invitation is extended to those attending the 22e Salon International de l'Aéronautique, May 24 to June 2, to visit the exhibit of United Aircraft Export Corporation at Le Bourget Airport.

CONVAIR 880 — Air conditioning of the Convair 880 jet airliner for the maximum in passenger comfort will be provided by Hamilton Standard freon refrigeration equipment. Its cooling capacity equals the output of a refrigeration plant making 20 tons of ice a day. Today, more than 40 types of turbine-powered aircraft are equipped with Hamilton Standard products. The 880s shown here are artist's concepts.

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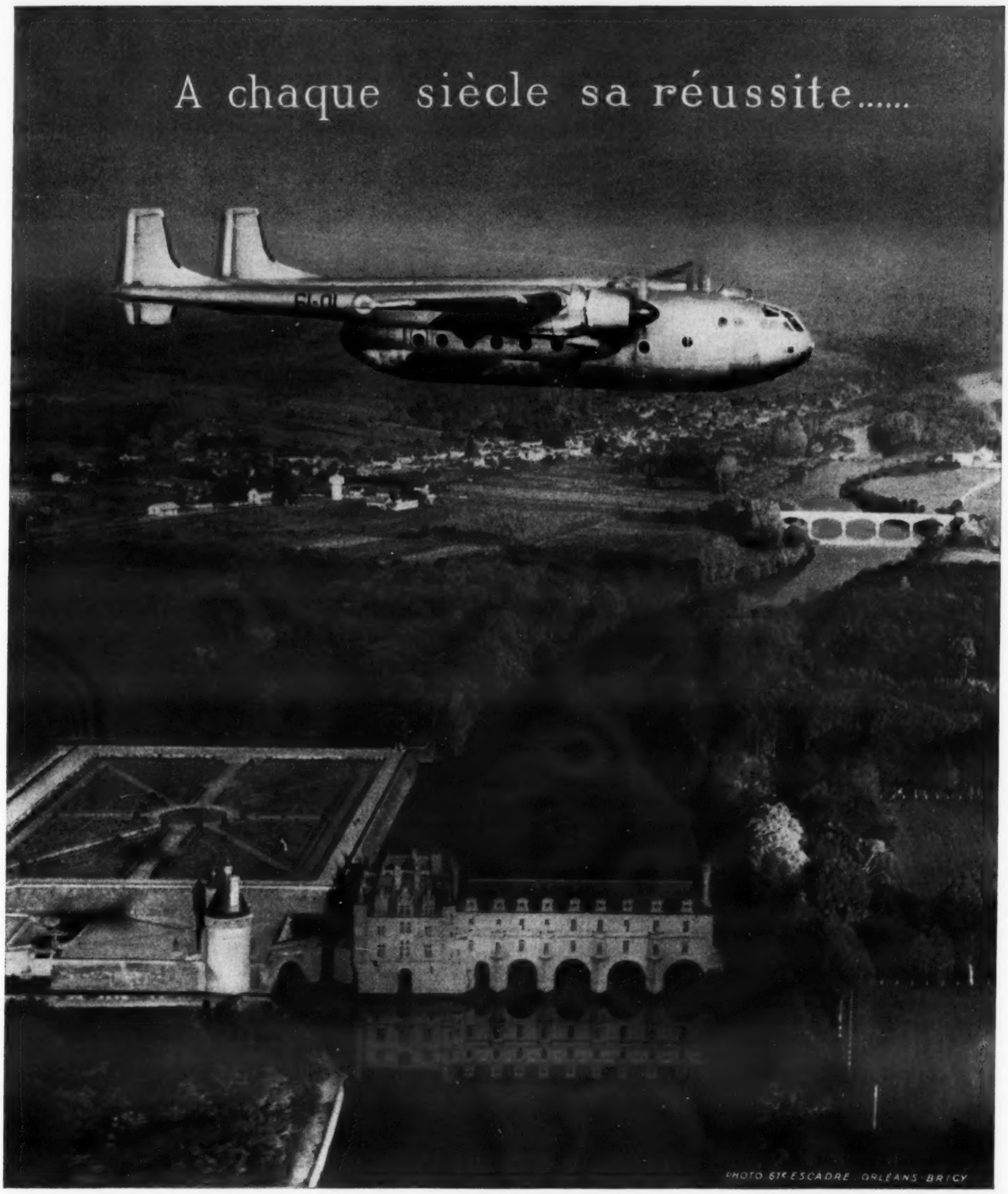

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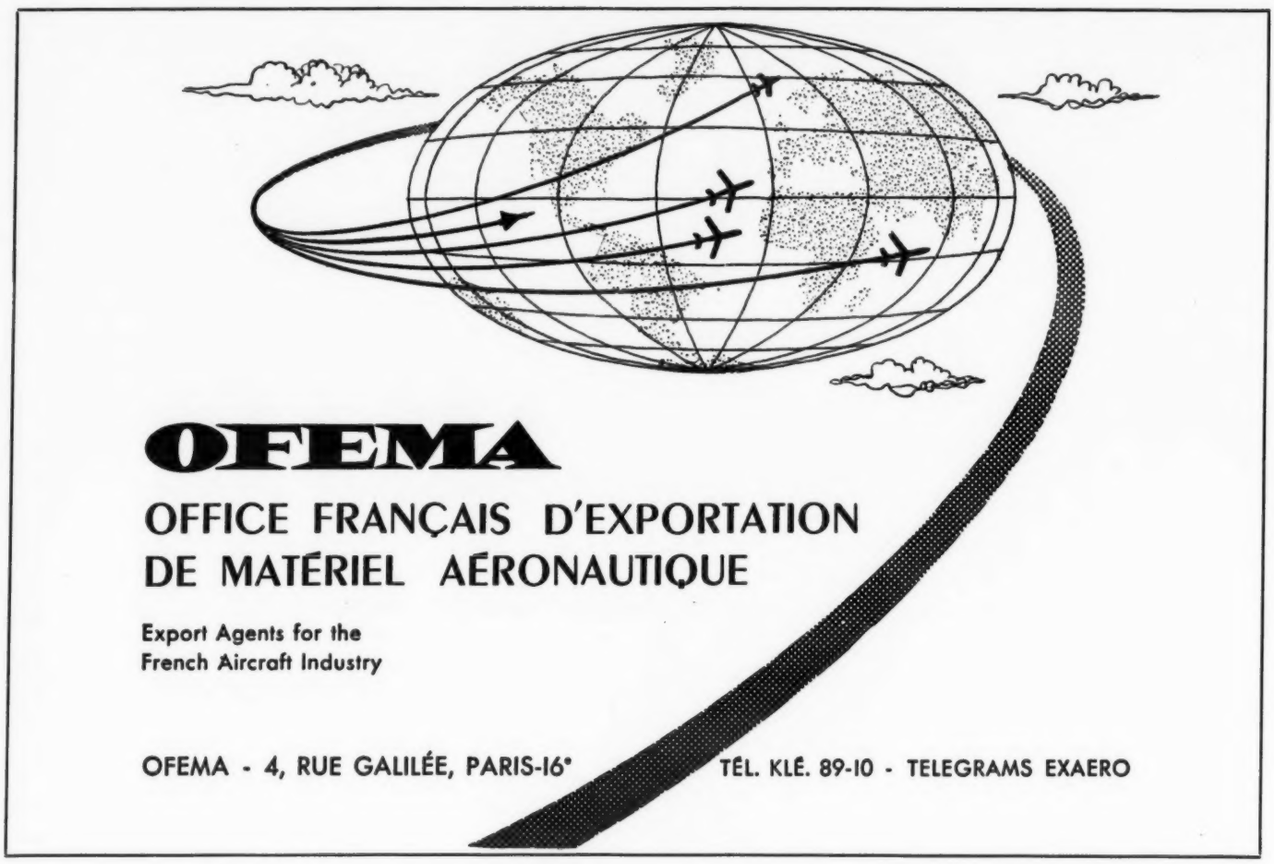
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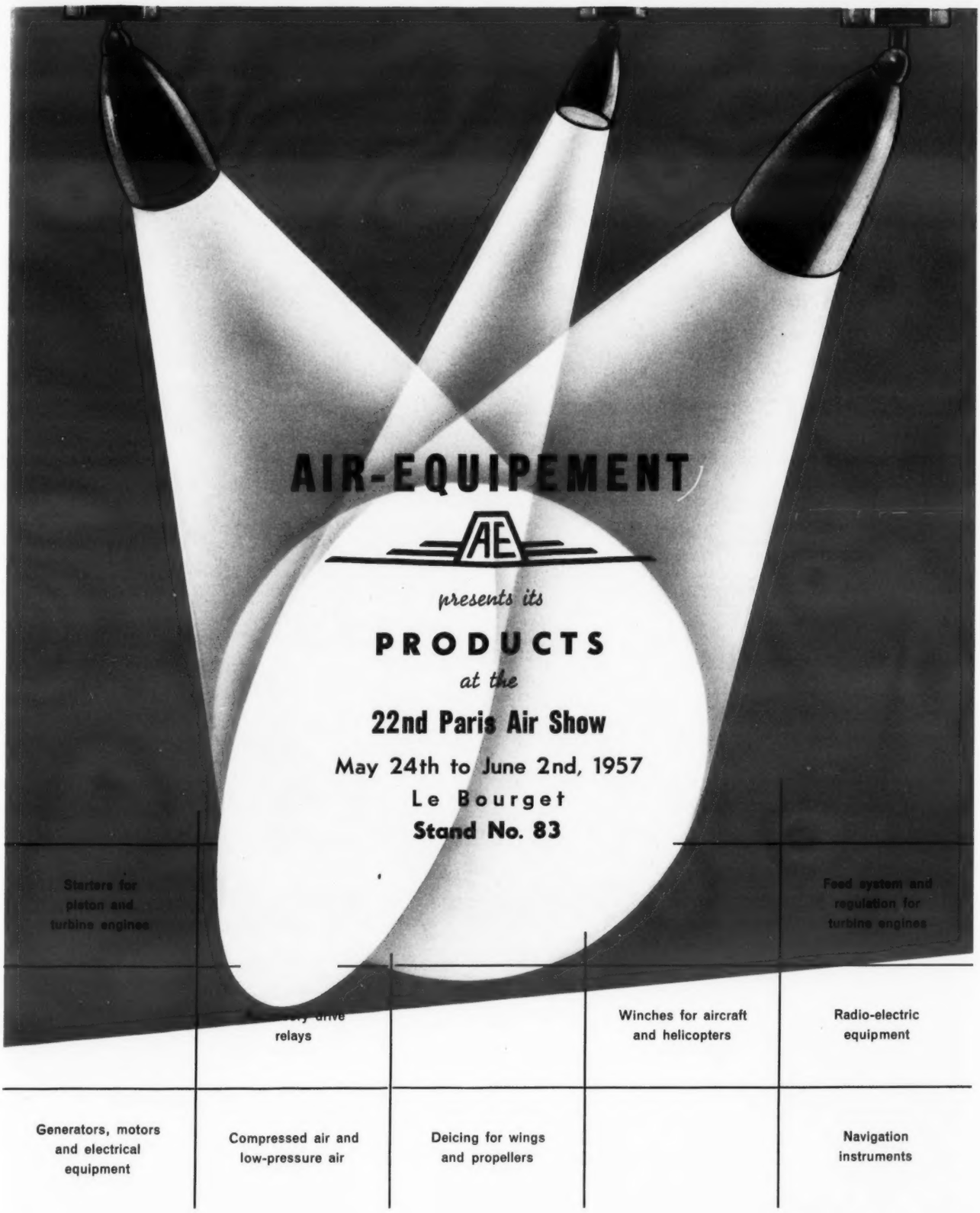

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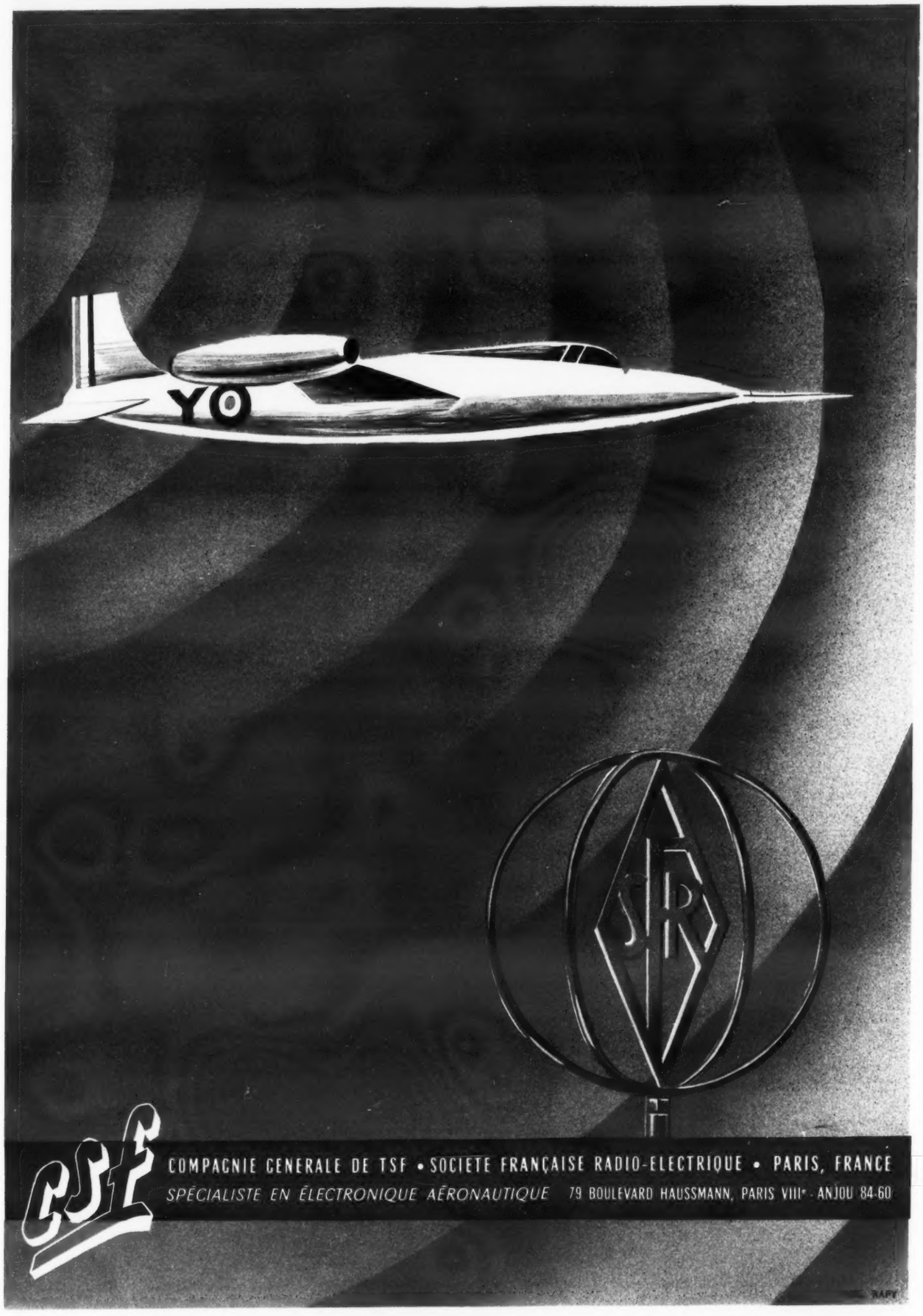
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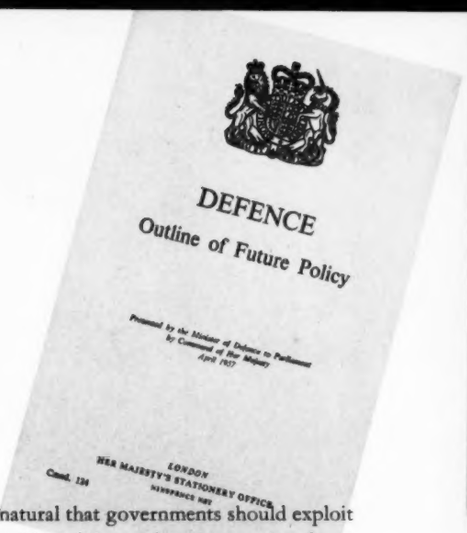
The British White Paper and the Arms Industry



By Pierre M. Gallois, Paris

It has taken the arms industry some twelve years to feel the impact of the strategic changes brought about by nuclear weapons. The Pentagon has now agreed to reduce its Air Force goal from 137 to 128 wings and to cut the strength of its new infantry divisions from 17,500 to 13,800 men. The British White Paper on Defence announces that substantial cuts will be made in the near future in personnel and "conventional" equipment. But it is today that the arms industry across the channel is beginning to feel the pinch.

In Europe and the rest of the world, the non-atomic Western countries are anxiously seeking new guarantees to replace those hitherto provided by the "big battalions". A new era is opening in military affairs. Technology is forging its instruments, the economic situation of the Western nations is hastening its advent, and Khrushchev's ultimatum of last November would be sufficient justification for advancing into the new age without hesitation if it were not for the fact that the scale of threats hanging over the West includes so many other possible conflicts besides an all-out atomic war.

The tremendous power of destruction of nuclear weapons and the stock-piling of atomic bombs have reversed the relative importance of the weapons carrier and the weapon itself. For centuries past a nation's military strength has been measured by the number of its land, sea and, more recently, air units. Needless to say, each nation had ammunition in its arsenals and depots. The specific power of destruction of this ammunition remained more or less constant, however, so that the decisive factor became the number of men and machines capable of delivering the fire power to the enemy. The Hiroshima bomb and, more particularly, the bombs exploded at Bikini, Eniwetok and in Siberia have completely invalidated this theory. Now, with A bombs tens of times more powerful than the 20 kiloton bomb, and above all with thermonuclear projectiles equivalent to 10, 15 or even 50 megatons of T.N.T., vastly greater damage could be inflicted by a single "carrier vehicle".*

* A "carrier vehicle" here is not only an aircraft, tank or warship, but also the corresponding air, ground or naval units.

The following expression represents the relation between the unit of fire power and the carrier vehicle:

$$P \times n = k$$

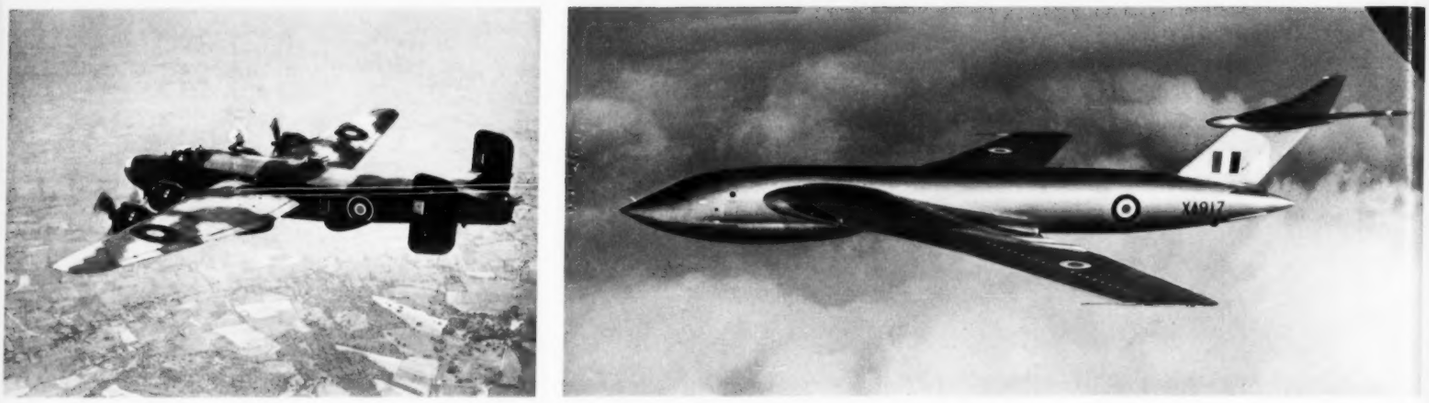
where P is the specific power of destruction of a given unit of fire power, n the number of carrier vehicles, and k a given amount of destruction. An increase in factor P should, at any rate in theory, enable the value of n to be reduced accordingly. If the calculation is based on equivalent tons of T.N.T. the reduction in n is not proportional to the increase in P because of the wasted energy, the "overkilling", of the nuclear projectile. Allowance must also be made for the initial losses suffered by a defensive coalition which keeps its nuclear strength for use only in retaliation to an aggression. Finally, the efficiency of the enemy's defences as well as the mistakes made in carrying out reprisals must be taken into account, allowing sufficient margin for error in the evaluation of these various factors. All this, however, does not alter the fact that, rather than basing its strength on the accumulation of the greatest possible number of carriers, each with a limited fire power, a nation possessing nuclear weapons will speculate more heavily on P than on n. Financial considerations will rarely permit it to acquire both highly destructive explosives and a large number of carriers.

It is natural that governments should exploit the capacities of the nuclear weapon insofar as they enable economies to be made in the design, production and operation of carriers. Compared with what it was in 1944, the present and, above all, future composition of S.A.C. and R.A.F. Bomber Command, with a few hundred and a few tens of heavy aircraft respectively, illustrates this fact. Admittedly, the manufacture of each of the aircraft comprising these fleets takes far more manhours than did their forerunners, but it is doubtful whether, on the overall view, industry can make a real living out of them.

Though it may be of advantage from the financial point of view and is certainly paying in the matter of personnel strength, a military policy designed to exploit to the full the tremendous specific power of destruction now attainable with nuclear weapons would be singularly dangerous. It would place any country adopting it before the alternative of total war or capitulation. By excessively reducing quantity, such a country would be obliged to resort to nuclear weapons, since the small number of carriers available would provide inadequate fire power if armed only with conventional T.N.T. ammunition.

Because of the very vastness of the destruction produced by atomic weapons, it is obvious that the new explosive would not be used unless what was at stake in the struggle were absolute-

"There is at present no means of providing adequate protection for the people of this country against the consequences of an attack with nuclear weapons", states the British White Paper on Defence. — Los Angeles in the glare of an atomic test bomb exploded 300 miles away in the Nevada desert.



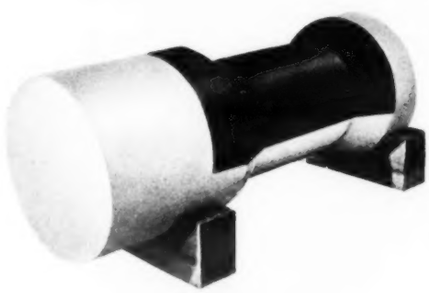
Within 15 years the gross weight of strategic bombers has been trebled, and range and cruising speed have grown accordingly. – *Left*, British Handley Page *Halifax* bomber of World War II. *Right*, the *Victor* transonic high-altitude jet bomber produced by the same firm and about to go into squadron service.

ly vital to the belligerents. The only absolutely vital stake is the very existence of a whole nation. But between this extreme and peaceful coexistence a whole range of conflicts of varying degrees of importance is possible. These conflicts do not justify—do not "deserve"—recourse to weapons of mass destruction and cannot be avoided simply by possessing such weapons, which thus lose all value as deterrents to a would-be aggressor.

The closer nuclear parity approaches and the greater the risk involved in resorting to weapons of mass destruction, the bigger must conventional armed forces be. Duncan Sandys appears to have recognized this problem when he asked: Should we feel justified in retaliating with nuclear bombs in the event of a local attack? If not, what proportions would the attack have to take before we should feel disposed to retaliate in this way? As long as there was any doubt on this point, an aggressor would be tempted to take the risk... that is why the Western Allies must maintain substantial ground and air forces in Germany...

Britain's Defence Minister was alluding indirectly to what may be called the "flash point" of a nuclear war. How serious must an aggression be before it attracts atomic reprisals? In our view, this flash point is not fixed. It varies with the growth in the aggressor's aero-nuclear potential and with the value of the stake in the eyes of the big atomic Powers. In Europe the "substantial ground and air forces" referred to by Duncan Sandys have the task of "discouraging" a limited aggression. Their size would oblige a would-be aggressor to deploy his forces on so large a scale as might well justify atomic reprisals.

Thus "big battalions" still have their value. Though today out-distanced by Britain in the matter of nuclear explosives, France has the advantage of not being in a position to consider solutions as radical—and as one-sided—as proposed by the British White Paper. Being fully aware of the wide variety of threats hanging over her—or that might hang over her—either as an individual country or within the framework of collective defence, she is obliged to equip herself with the largest possible number of carriers with low fire power, at the same time planning to add later a sufficiently powerful nuclear force to discourage either blackmail or the threat of atomic aggression. One of the main features of the French armament industry—and particularly of the aircraft industry—is that it is geared to an overall defence plan rather than solely to the nuclear deterrent theory.



American atomic bomb... ?

Boeing B-29 *Super Fortress* with 4,000-lb. H.E. bombs.

Defence without depth and missiles

Some of the repercussions of the nuclear explosive's vast specific power of destruction have been outlined above. The fact that the bulk and weight of atomic weapons has been progressively reduced also has important technical and military consequences. Until Washington announced a few years ago that the F-84 fighter-bomber was capable of carrying a nuclear bomb, it had been thought that only the heaviest aircraft could deliver the new projectiles. True, the destructive power of the bombs carried beneath the wings of a fighter is inferior to that of the bigger bombs transported inside a heavy multi-engine bomber. Nevertheless, the margin between the effects of these low-calibre atomic projectiles and those of conventional T.N.T. ammunition is still wide enough to overturn completely all traditional ideas on armament design and operational planning.

The "miniaturization" of atomic warheads has enabled them to be used in surface-to-surface, surface-to-air and even, it has recently been said, air-to-air missiles. Fifteen years ago it took a 30-ton bomber to carry some 5 to 6 tons of explosive at 250 m.p.h. over distances up to 1,000 miles. Today we are not far from the point where a warhead with two or three thousand times the destructive power can be delivered by a missile over greater distances and at several times the speed. On the defence side, the inclusion of an atomic warhead in

Starting point for new developments: France's SO.4050 *Vautour B* bomber, with bombardier's post in the nose.

France's SO.9050 *Trident 2* supersonic fighter with rocket motor and two jet engines; air-to-air missile under the nose.

anti-aircraft missiles would restore to active defence some of the efficacy which it had lost under the aero-nuclear aggression theory. If such an aggression were carried out with the aid of surface-to-surface or air-to-surface missiles, the conventional defence system, even if itself based on the use of missiles, would be impotent. If the attack were made by piloted aircraft, it would suffice for even a small percentage of the offensive force—which itself could be limited in size—to reach a few vital targets, and the aggressor's war aims would have been achieved. And in cases where there was any doubt in the victim's mind about the efficiency of his defences, a mere threat of atomic attack might well be enough to obtain his capitulation without combat.

The British Government has drawn the following conclusions from this situation (White Paper, paragraphs 61 and 62): "Having regard to the high performance and potentialities of the *Vulcan* and *Victor* medium bombers and the likely progress of ballistic rockets and missile defence, the Government have decided not to go on with the development of a supersonic manned bomber, which could not be brought into service in much under ten years... Work will proceed on the development of a ground-to-air missile defence system, which will in due course replace the manned aircraft of Fighter Command. In view of the good progress already made, the Government have come to the conclusion that the R.A.F. are unlikely to have a requirement for fighter aircraft of types more advanced than the supersonic P.1, and work on such projects will stop." The Paper thus considers that missiles will definitely oust manned aircraft, for both offence and defence, in roughly ten years from now, i.e., about 1965—1967.

These conclusions appear to be founded on the following reasoning:

1. Since the conventional forces in being on either side of the Iron Curtain are so unequal in strength, the West would be obliged to retaliate with atomic weapons to any major threat, whether nuclear or otherwise.

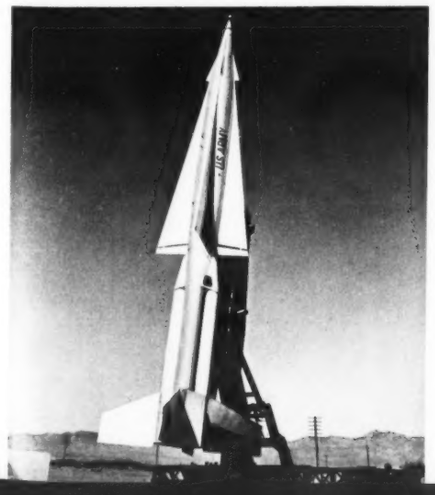
2. As Britain constitutes a vital stake in any such struggle, not only would she use her own instruments of mass destruction, but also her principal ally would be willing to run the risk of threatening nuclear reprisals.

3. At this point two subsidiary suppositions are interposed. Firstly, this determination is sufficient to discourage aggression, and the ultimate aim, which is to make this type of war impossible rather than to wage it successfully, is attained. Secondly, fighting actually breaks out and develops under conditions totally unlike any experienced in the past, conditions under which, in particular, conventional active defence would be ineffective. Hence every effort must be made to replace the conventional defence system by a system of ground-to-air missiles, to be directed initially against manned aircraft but destined primarily to prepare the way for an anti-missile missile. This supposition is unavoidable, since the White Paper gives the piloted bomber a life of only another ten years with R.A.F. Bomber Command and hence, by inference, with a potential enemy.

4. Since nobody really knows just what results can be expected in the future from such a defence system, it is essential to possess a

Potez 75 armoured ground attack aircraft for police operations; takes off from any cow pasture.

The United States has supplied N.A.T.O. countries with *Nike-Hercules* guided anti-aircraft missiles (left), *Honest John* unguided artillery rockets (centre) and *Matador* remote-controlled surface-to-surface missiles (right) for use in Europe.



"...In view of the good progress already made, the Government have come to the conclusion that the R.A.F. are unlikely to have a requirement for fighter aircraft of types more advanced than the supersonic P.1, and work on such projects will stop." (British White Paper, Article 62). — The production P.1B.

reprisals force which cannot be destroyed on its bases. Several measures are envisaged to ensure this force's safety, including active local defence by means of manned aircraft initially, and later by ground-to-air missiles (whose efficiency, however, can be questioned). As the reprisal force would be employed against the enemy's vital centres, and as these centres will be large in size and fixed in location, surface-to-surface missiles can be used against them more easily than against mobile targets. What, therefore, would appear to be needed is a missile of intermediate range and of a degree of accuracy of about one percent of its range.

In adopting this defence policy, a government is frankly betting all its money on one horse. The White Paper opens with an apologia in which technical and military arguments are preceded by a discussion of economic necessities. Faced with the alternative of seeing the country's economy deteriorate still further under the impact of excessively heavy defence spending, or of creating a strictly atomic-cum-missile defence instrument, the White Paper chooses the latter solution. It is clear however that such a defence system, if carried to its logical conclusion, would be of solely national and not collective value. Obviously Britain would scarcely run the risk of countering threats directed at other countries with warnings of nuclear reprisals. The theory of "graduated deterrence" could not be maintained by means of so specialized a defensive instrument, capable merely of holding one corner of the European bastion.

The collective defence point of view as put forward by N.A.T.O. is well known. National reactions are also just as logical as is the White Paper in its deductions that apply only to the economic and geographical situation of Britain. The trend it reveals is towards replacing the system of collective deterrence to aggression—a system in which one partner uses the threat of nuclear reprisals to protect its allies—by a "national deterrent". Although we are still a long way from such a situation, the Kremlin has recently warned Denmark, Norway, Holland and several other countries of the dangers of any geographical decentralization of atomic power.

Future air defence bases in Europe may look like this American *Nike* anti-aircraft battery near Lorton, Virginia.

In the field of development and production, the application of the principles laid down in the White Paper will entail a gradual reconversion of the British arms industry, with major efforts being concentrated on nuclear explosives and on missiles of various categories. In addition, of course, the sections of the industry devoted to commercial aviation will also inherit some of the resources hitherto absorbed by military aviation. But, here too, the consequences of the shift in emphasis will not all be favourable. It has become a commonplace to point out the benefits which the manufacture of civil aircraft has derived from experience gained in the production of combat aircraft. The White Paper announces that the two branches must go their separate ways at a moment when civil production is still a long way from being able to dispense with the military test bed.

The White Paper states: "It must be frankly recognised that there is at present no means of providing adequate protection for the people of this country against the consequences of an attack with nuclear weapons. Though, in the event of war, the fighter aircraft of the Royal Air Force would unquestionably be able to take a heavy toll of enemy bombers, a proportion would inevitably get through. Even if it were only a dozen, they could with megaton bombs inflict widespread devastation." (para. 12.) It follows that the possession and the protection of a powerful reprisal instrument become essential to prevent recourse to war. The possession of such a reprisal instrument presupposes a new technological approach, with the accent placed on fire power rather than on number of "carriers". Protection of the reprisal force demands a combination of active and passive defence measures, and hence the development of new techniques.

The present exorbitant cost of fire power has forced the British Government to make a choice. The United States and especially the Soviet Union appear to be able to explore virtually the full range of arms techniques and at the same time to keep large forces in being. But between the Soviet position and the new British defence policy there is room, from both the financial and the military point of view, for a large number of other systems, so that the aims pursued by the armament industry may well differ considerably from country to country.

What's in the Air?

Extracts from Interavia Air Letter, *daily international news digest, in English, French and German. All rights reserved.*

Douglas Model 1906A project for a combat zone and naval transport, suitable for operation from carrier decks or unimproved land bases. Four Lycoming T55 turboprops.

MILITARY AFFAIRS

● **Reduction and conversion** are the *leitmotiv* of the British White Paper on Defence: a reduction of defence expenditure from £ 1,548,000,000 in the last budget year to £ 1,420,000,000 for the 1957—58 year; progressive limitation of the military production programme to atomic weapons and guided missiles (some of them supplied by the United States); cancellation of the development of a supersonic bomber; cancellation of any development programme for a fighter to succeed the English Electric P.1; progressive replacement of the V-class medium bombers with ballistic missiles; reduction of the total strength of all three services to 625,000 men within the next twelve months; reduction in the British Army of the Rhine from its present strength of 77,000 men to 64,000; reduction by half in the number of aircraft stationed with the 2nd Tactical Air Force in Germany; equipment of the remaining two squadrons with atomic bombs; shift in emphasis in the Royal Navy to carrier groups (each consisting of an aircraft carrier plus support ships); abolition of National Service by 1960.

A standard SO. 1221 *Djinn* helicopter piloted by Jean Dabos (right) has reached the record altitude of 8,482 m (absolute record for all helicopter categories). The previous altitude record for all categories of helicopter was 8,229 m and was set up by a SE. 3130 *Alouette II* in June 1955. Left, Jean Castagne, engineer in charge of helicopter flight tests at Melun-Villaroche.

this low-level attack and all-weather combat aircraft.

● **The West German Government's Budget Committee** has decided to reduce by 28 the number of generals on the establishment of the armed forces. The cut means that the Air Force will have to do without two commands which were to have been set up for home defence—the Northern Command and the Southern Command.

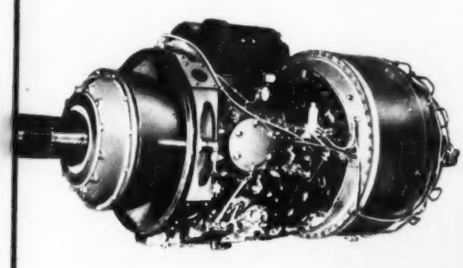
● **The Soviet Union** has set up a new "rocket force" on a par with the Army, Navy and Air Force to take over missile development and air defence, according to dispatches from Eastern Europe. Western experts say the Soviet Government has ordered a "crash programme" to catch up with the West in nuclear power and has established missile troops as a separate branch of the armed forces in an attempt to speed progress.

● **Colonel Howard L. Burris,** Air Attaché to the U. S. Embassy in Berne, relinquished his post on May 1st to take up a new appointment as Chief of International Liaison with the U.S. Air Force at the Pentagon. He is succeeded by Colonel John C. Habecker.

● **Colonel Claude de la Ruelle,** for the past few years Military and Air Attaché to the French Embassy in Berne, has left Switzerland to take up a command in North Africa. He is replaced by Colonel François Richard de Soultrait.

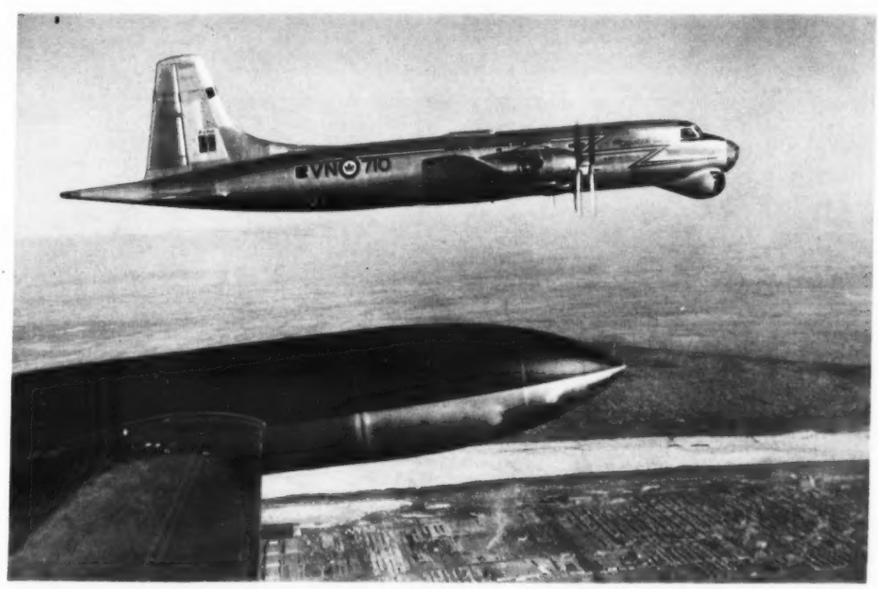
INDUSTRY

● **U.S. aviation exports** in 1956 exceeded $ 1,000,000,000 for the first time since 1946. Total



Lycoming T55 gas turbine, designed to power either fixed-wing aircraft (model LTC4A-1) or helicopters (model LTC4B-1). Picture shows the LTC4A-1 version: take-off rating 1,500 s. h. p. plus 378 lbs. residual thrust. The LTC4B-1 model has a take-off rating of 1,600 s.h.p. plus 190 lbs. residual thrust.

The prototype of the Canadair CL-28 (CP-107) *Argus* anti-submarine and long-range patrol aircraft took off on its first flight on March 28th.



● **The Swedish Air Force** and the Department of Roads and Waterways are examining the possibility of using a number of highways as reserve landing strips. These "road bases" could accommodate four aircraft each in wartime. In peacetime, they could be employed as auxiliary landing strips. Construction of road bases would cost approximately half the amount spent on the reserve airfields in use at present. In view of the atomic threat, as many bases as possible should be built. In the opinion of Major General Peyron, Chief of the Air Staff, the J35 *Draken* will probably be the last manned fighter of the Swedish Air Force. The aircraft is to be built in several versions and later equipped with air-to-air missiles. Towards the end of the 1960's, however, the *Draken* will doubtless be replaced for medium and high altitude missions by guided missiles and used only at low altitudes where missiles will be ineffective. As a carrier of tactical atomic bombs, the Saab A32 *Lansen* will play an important part. Both Saab and the Swedish Air Board are already considering a successor to

Rocket test beds under construction: left, building a rocket engine test stand at the Neosho, Mo., plant of Rocketdyne Division of North American Aviation, Inc.; right, this test stand at Martin's Denver plant will be used for static testing of the *Titan* intercontinental ballistic missile.

exports reached $ 1,044,487,000 in 1956, compared with $ 728,514,000 in 1955, an increase of more than 43%. Irving H. Taylor, Export Director of the Aircraft Industries Association stated that, expressed in terms of economic importance to the country and the industry, this represents an advance from 8.6% of U.S. gross aviation production values in 1955 to 11% in 1956 or, stated in terms of manpower utilization, an employment for export production of 88,451 workers throughout 1956 as contrasted with 63,486 in the previous year. A notable increase was in new commercial transport aircraft weighing more than 3,000 lbs. This category rose from 95 to 151 units, a gain of 59%, and in value from $ 81,145,000 to $ 132,798,000, an increase of 64%. Utility, personal and liaison aircraft gained 28% in the number of units and nearly 50% in value.

● **The United States and Japan** on April 9th signed an agreement on the production of jet aircraft in Japan. Shin Mitsubishi Heavy Industries will manufacture 300 North American F-86 *Sabres* by September 1959, while Kawasaki Aircraft Co. will build 210 Lockheed T-33 jet trainers before the end of 1958.

● **Northrop Aircraft Inc.** has established a new division to be known as Northrop International, which will be responsible for all overseas programmes of the company. J. Gilbert Nettleton, Jr., formerly Vice President, Customer Relations for the Radioplane Company, a Northrop subsidiary, has been elected a corporate Vice President and assigned responsibility for the management of Northrop International. His offices will be at 9756 Wilshire Boulevard, Beverly Hills, the new corporate headquarters after May 1st.

De Havilland-Canada DHC-4 *Caribou* multi-purpose transport, fitted with two Pratt & Whitney R-2000-D5 engines of 1,450 h. p. take-off rating. – Gross weight 24,000 lbs., cabin for a maximum of 28 fully-equipped troops or equivalent load of cargo; cruising speed 160 knots; take-off distance to 50 ft., approx. 800 ft. in still air; landing distance from 50 ft. approx. 700 ft.

● **A Lockheed U-2** high-altitude research aircraft on a mission for the National Advisory Committee on Aeronautics, crashed in a remote desert area in Eastern Nevada on April 4th. Robert L. Sieker, Lockheed test pilot, who was at the controls, was killed in the accident.

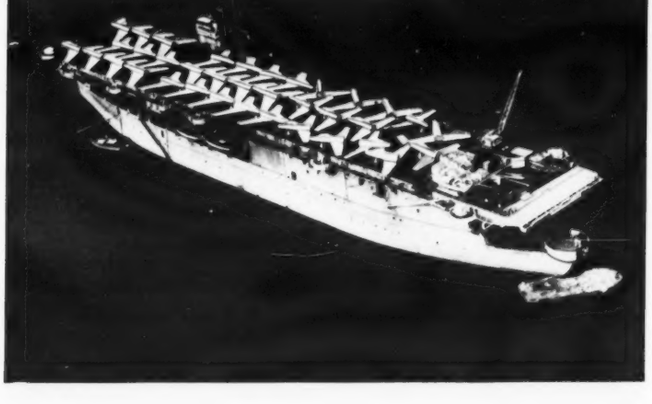
● **De Havilland Aircraft Co. (Canada) Ltd.** has delivered two 6-passenger *Beaver* amphibians to the Government of Pakistan for use on customs patrol operations in West Pakistan and along the Arabian coast. Two agricultural versions of the aircraft will also be delivered shortly, bringing Pakistan's *Beaver* fleet up to seven. One of the agricultural *Beavers* will also be an amphibian. Equipped with long-range wing-tip fuel tanks, the amphibian will have a range of 736 miles with a five-hour endurance capability.

● **Scottish Aviation Ltd.** is expecting an order from Iran for three *Twin Pioneers*. Interest in the aircraft has also been shown in Australia and New Zealand.

● **Société Anonyme Belge de Constructions Aéronautiques** has been forced to dismiss 125 of the 200 men employed at the Gosselies test base following the cancellation by the Ministry of National Defence of a repair and maintenance contract. Of the 75 men retained, only one repair team will be kept at Gosselies, the others will be transferred to the Haren plant. Union officials and industry leaders have described the Ministry's decision as a serious threat to the Belgian aircraft industry.

● **Société Anonyme des Ateliers d'Aviation Louis Breguet** is moving its light aircraft division under M. Jarlaud and M. Cayla from Vélizy-Villacoublay to premises made available by Société Air-Fouga at Aire-sur-Adour. This move is in line with Breguet's policy of decentralization which will leave the Vélizy-Villacoublay factory to specialize in prototype construction. The reorganization will considerably expand production facilities for the Br.901, Br.904 and Br.902 gliders.

Aircraft for the Indian Air Force: "mothballed" forward fuselages of 13 *Ouragans* and 23 *Mystère IVAs*, built by Générale Aéronautique Marcel Dassault, on the deck of the French aircraft carrier *Dixmude*. The rear fuselages are stowed below decks.



Matador parade at a U.S. Air Force base in West Germany. The Martin TM-61s are mounted on highly mobile, roadable launching platforms.

May 20th is the thirtieth anniversary of the day on which Charles A. Lindbergh took off on his historic flight from New York to Paris. – The "Spirit of St. Louis", with Wright J-5 *Whirlwind* engine (223 h. p.), was built by Ryan Airlines Inc. (an indirect forerunner of today's Ryan Aeronautical Co.) within 60 days at a price of $10,580.

Pan American World Airways' first Boeing 707 jet transport is taking shape at the Renton plant. So far, 11 airlines have ordered a total of 141 Boeing 707s.

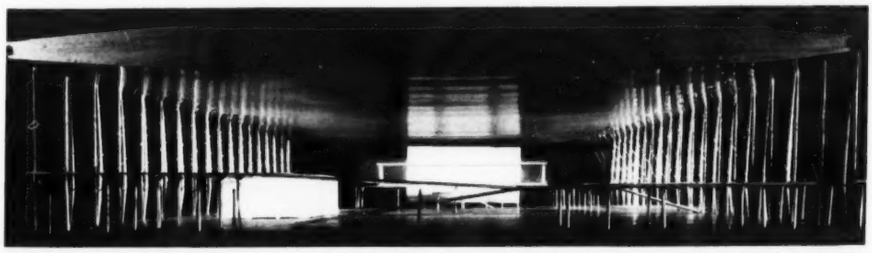
● **BMW-Triebwerksbau GmbH** is the new name of the former BMW-Verwaltungs-GmbH, Munich. The firm's activities will include development, manufacture and sales of engines and power plant of all kinds, with particular emphasis on aircraft engines, spare parts and equipment. BMW-Studiengesellschaft für Triebwerksbau, which is managed by M. Sachse, will be taken over by BMW-Triebwerksbau GmbH.

● **Cooperation between BMW and Orenda** may be in the offing. At the request of the German Government, a group of officials from BMW-Triebwerksbau GmbH led by Dr. Seyfried recently visited Orenda Engines Ltd., Malton, to study the facilities required and the costs involved in setting up a shop in Germany for overhauling Orenda engines.

● **Ernst Heinkel A.G.** is planning to set up an aircraft assembly and overhaul facility in the Saar, according to reports from Saarbrücken. The plant is to be built near Ensheim Airport.

AIR TRANSPORTATION

● **The U. S. Civil Aeronautics Administration** has before it 25 turbine-powered aircraft for certification during the next three years. Eleven of them are manufactured in Europe and some of these 11 have already been ordered by U.S. airlines. The programme also includes 14 turbine-powered aircraft manufactured in the United States, 9 new helicopters and 16 new smaller aircraft. The foreign-made aircraft are the Fokker F.27 *Friendship*, a cargo and passenger version of the Bristol *Britannia*, the Napier *Eland*-powered Convair, two new versions of the Vickers *Viscount*, the *Comet IV*, the SE.210 *Caravelle*, the Aviation Traders *Accountant*, the Vickers *Vanguard* and the Armstrong-Whitworth AW.650 (the latter is in the design stage for future production). The list of American aircraft before the C.A.A. includes the Lockheed *Electra* and the Lockheed GL-108 turboprop transports, four versions of the Boeing 707, three of the Douglas DC-8, the Convair 880 and four jet-powered executive transport types—the Fairchild M-185, the Lockheed GL-135, the North American NA-246 and the McDonnell 119.



The 1958 International Exhibition in Brussels: model of the transport pavilion, the largest of the exhibition buildings, with an area of nearly 151,000 sq. ft.

Bridge building by helicopter: a U.S. Army Vertol H-21C lifts a 3,200-lb. pontoon.

● **Reports of 452 near-collisions** were received by the Civil Aeronautics Board from civil and military aircraft during the last four months of 1956. The figure represents a daily average of 3.7 near-misses. A total of 4,429 persons were aboard the reporting aircraft. Nearly nine out of ten of the incidents occurred in controlled airspace. The near-collision reports came from 259 military aircraft and 193 civil aircraft.

● **Trans World Airlines** sustained a net loss of more than $ 2,300,000 in the 1956 business year. The downward trend began in 1955 when the previous year's earnings of $ 10,336,132 dropped to $ 5,407,192.—A few weeks ago it was reported that T.W.A. is planning to dismiss some 2,000 employees. Meanwhile, the company is hoping to raise about $ 37,000,000 by selling convertible senior securities to its stockholders. The airline has asked the Civil Aeronautics Board for permission to sell Hughes Tool Co., which owns 74.2% of T.W.A.'s common stock, its pro rata share of the offering. Hughes would also be entitled to buy a portion of any unsubscribed shares. The funds obtained are to be used by T.W.A. to pay in part for eight aircraft delivered last year and 25 aircraft to be taken over in 1957. The stock sale is subject to approval by T.W.A. shareholders.

● **American Airlines Inc.** earned a net profit of $ 19,572,713, or $ 2.44 per common share, in 1956, as against $ 18,608,281, or $ 2.42 per share, in 1955. Gross revenues amounted to $ 291,452,866, compared with $ 260,756,657 the previous year. With the rise of 11.8% in gross revenues, there was a rise of 14.3% in costs. The company last year carried 7,793,000 passengers, an increase of 6.5% over 1955, while passenger miles went up 12.4%. Cargo ton-miles increased by 7%.—In his annual report to shareholders C. R. Smith, the company's President says that the substantial decline in the profit margin in 1956 is a trend likely to continue unless fares are raised. He points out that in 1956, average airline fares were slightly below 1942 level, whereas during the same period railroad fares went up nearly 40% and bus fares more than 25%.

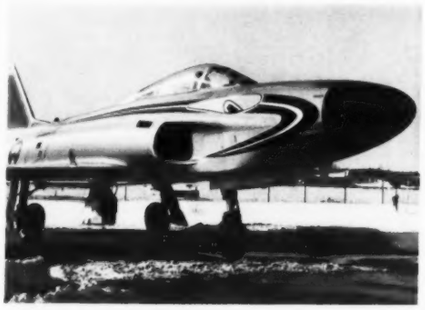
● **Canadian Pacific Airlines'** $ 20,000,000 expansion programme, which will add 13 more aircraft to the company's fleet, started on May 1st with the delivery of the first of eight DC-6Bs on order. Three more will be added at monthly intervals until August. Delivery of the first of five Bristol *Britannias* is to begin in September and continue at the rate of one a month. C.P.A. has an option on five more in 1958. Storm radar is to be fitted in all the new aircraft. Later this year a $ 750,000 DC-6B

flight simulator will be delivered from Canadian Aviation Electronics, Montreal. A $1,500,000 hangar is to be built to house the *Britannias* and a $ 800,000 extension to the administrative offices has just been completed.

● **Transcontinental S.A.,** Argentina's new private airline is said to be financially backed by Howard Hughes, the American industrialist, according to reports from Rio de Janeiro.

● **F.G. Miles Ltd.,** of Shoreham, has applied to the Air Transport Advisory Council for permission to run four seasonal scheduled passenger, freight and mail services between Shoreham–Dieppe, Shoreham–Le Touquet, Shoreham–Paris (Le Bourget) and Shoreham–Jersey for a period of seven years, commencing this summer. In its application, Miles has specified *Marathon* four-engine transports and *Herons,* but ultimately the company's own Lycoming-powered HDM-106 design is to be used. If the application is granted, Miles may form a subsidiary company and operate services to France in conjunction with a French firm. At present the only scheduled operator at Shoreham is Channel Airways, which flies *Doves* to Portsmouth, the Channel Islands and Paris. Opposition to the application is likely to come from B.E.A., Channel Airways, Silver City and Morton Air Services.

A new version of the *Lansen* two-seat low-level attack and all-weather combat aircraft, the S32C, began flight testing at Svenska Aeroplan A.B.'s airfield at Linköping on March 26th. The S32C is equipped for photographic reconnaissance, has been ordered in substantial numbers and is already in production.



Insignia of Sud-Aviation, the new company resulting from the merger of Sud-Est Aviation and Ouest-Aviation.

● **The International Society of Air Travellers and Air Transport Users** has been organized in London to protect the interests of people travelling by air. Chairman of the new organization is Cecil Turner, and headquarters are at Park Lane House, London, W.1.

A C-123 of the 513th Troop Transport Group, U. S. Air Force, over the snowy peaks of Alaska.

FIRST FLIGHTS

● The following aircraft began flight testing in late March or early April 1957: McDonnell F-101B *Voodoo* all-weather fighter, the second prototype of the Morane-Saulnier MS.760 *Paris* jet communications and executive aircraft, the English Electric P.1B twin-jet fighter, the Breguet 1100 light ground attack aircraft, the Canadair CL-28 (CP-107) *Argus* anti-submarine and naval patrol aircraft, and the Saab S 32C *Lansen* photographic reconnaissance aircraft.

AIRCRAFT AND POWER PLANT

● *Convair* is reportedly working on a development of the B-58 supersonic bomber.

● The *Northrop F-89J Scorpion* can carry air-to-air rockets with atomic warhead.

● The *CF-105* delta-wing all-weather fighter, of Canada's *Avro Aircraft Ltd.,* bears the additional designation *Arrow.*

● A production *SO.4050 Vautour* has reached a speed of more than 600 knots during a test flight, in the course of which it climbed to an altitude of 39,370 ft. in 4 mins. 49 secs. with a gross weight of 15 tons.

● A *SNECMA-ATAR 8* turbojet recently completed a type test at a thrust of 9,700 lbs.; specific fuel consumption at this power was less than 1 lb./lb./hr.

● *Fiat G.91T* is the type designation of a projected trainer version of the G.91 light-weight tactical support fighter.

● The *Lockheed L-1649A Starliner* has completed all official flight tests and will enter passenger service this summer.

● *Hispano Suiza* announces that the *R-804 jet* has made a 150-hour endurance test at a thrust of 3,310 lbs.; gas temperature behind turbine 670°C; specific consumption 1.065 lbs./lb./hr.—The R-804, derived from the R-800, has a seven-stage axial compressor and single-stage turbine. It is designed for speeds of up to Mach 1.8.

● On the occasion of the demonstration of the *Aerfer Sagittario 2* light-weight fighter at the Italian Air Force's Pratica di Mare test centre, Amedeo Carassai, Managing Director and Chief Engineer of Industrie Meccaniche Aeronautiche Meridionali Aerfer, announced that the aircraft is the first in a series of new light-weight combat types to be developed during the next two years for the Italian Defence Ministry, with American aid.

● France's Brétigny Flight Test Centre recently completed tests on a remote-control system for the *Vampire* jet fighter, which enables the aircraft to be guided from the ground within a radius of approx. 60 miles. *Vampires* with this system are to be used by the French Air Force as target drones.

● Early in March ground was broken at Muskogee, Oklahoma, for a vast new plant to produce high energy fuels. The plant will be built and operated by the Callery Chemical Company, of Callery, Pennsylvania, a firm which has conducted extensive research, backed by the Navy, into high energy fuels based on boron compounds. The synthetic fuel now to be produced is known as HiCal and will greatly improve the performance of jet aircraft and missiles.

GUIDED MISSILES

● The first production *Lacrosse* surface-to-surface missile has been completed. *Lacrosse* uses a solid-propellant rocket engine.

● A new Temco missile for air-to-surface use is mentioned for the first time; designation *Corvus.*

● *Sea Slug* is the name of a surface-to-air missile reported to have been under development for some time for the Royal Navy.

● *Zuni,* a new rocket missile, is announced by the U.S. Navy. It can be used either air-to-air or air-to-surface, employs solid propellants and is said to cost about $ 150 apiece.

● The *Bristol Bobbin* supersonic test vehicle was designed to test the Bristol *Thor* ramjet and components for a surface-to-air missile now under development at Bristol.

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Precise Control

Negligible Maintenance
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Assembles in minutes
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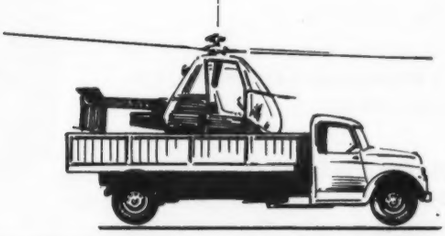

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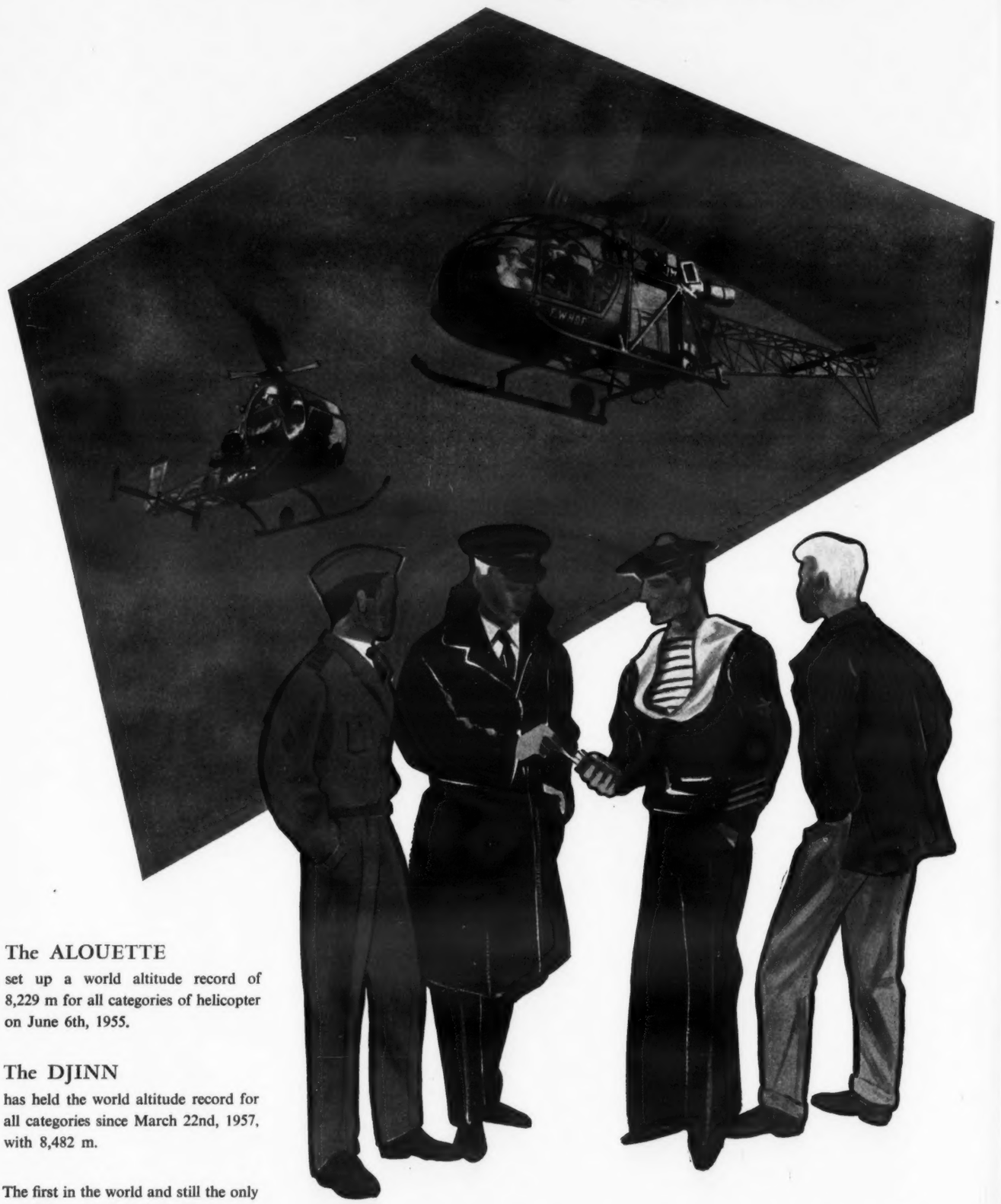

The ALOUETTE
set up a world altitude record of 8,229 m for all categories of helicopter on June 6th, 1955.

The DJINN
has held the world altitude record for all categories since March 22nd, 1957, with 8,482 m.

The first in the world and still the only 2 turbine-powered helicopters produced in quantity. The ALOUETTE and the DJINN supplement each other and together cover the full range of civil and military needs.

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THE TRIDENT II

light interceptor, an experimental batch of which has been ordered, will exceed twice the speed of sound and can use hastily prepared airfields. It is armed with an air-to-air missile carried beneath the fuselage.

THE BAROUDEUR

single-seat tactical support aircraft, powerfully armed and highly manœuvrable, takes off, lands and manœuvres on skids on all terrains.

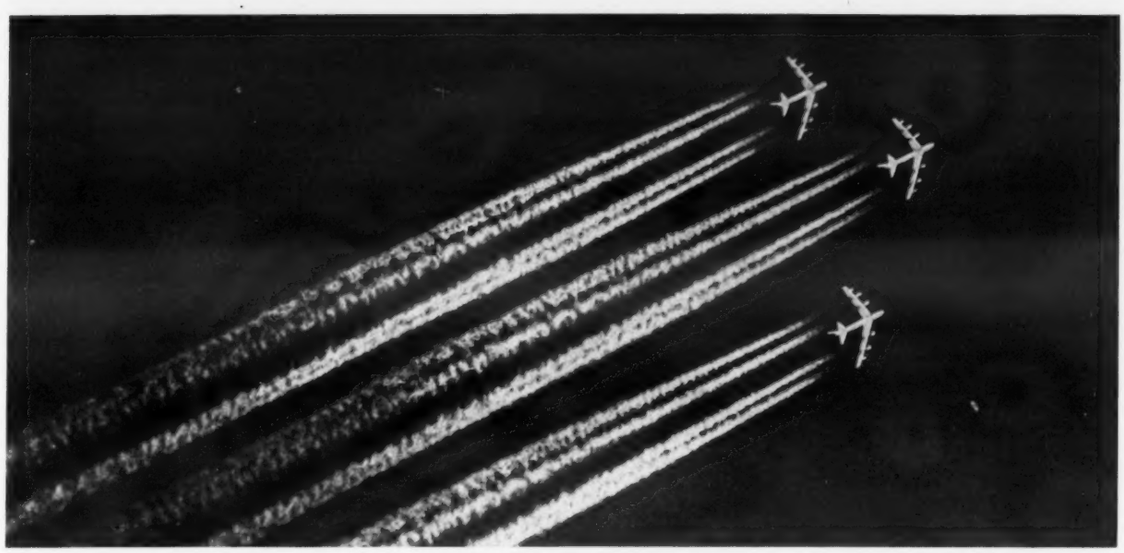
THE VAUTOUR

twin-jet combat aircraft ordered in large numbers by the French Air Force, in its 3 versions — all-weather fighter, ground attack and bomber.

SUD-AVIATION

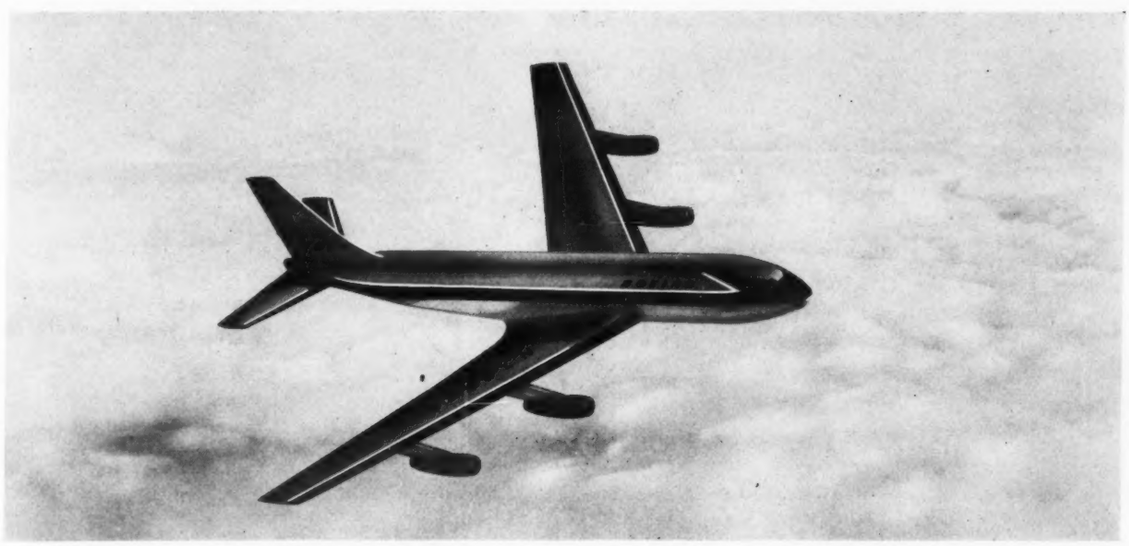
SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES

Head office: 37, Boulevard de Montmorency — PARIS 16e



Three « B-52's » at altitude. More than 1400 « B-52's » and « B-47's » have been built by Boeing.

Boeing has built more long-range, multi-engine jet aircraft than any other company in the world.



The 707 jetliner — test-flown over 2½ years — will bring you all of the advantages of this Boeing experience with jet aircraft.

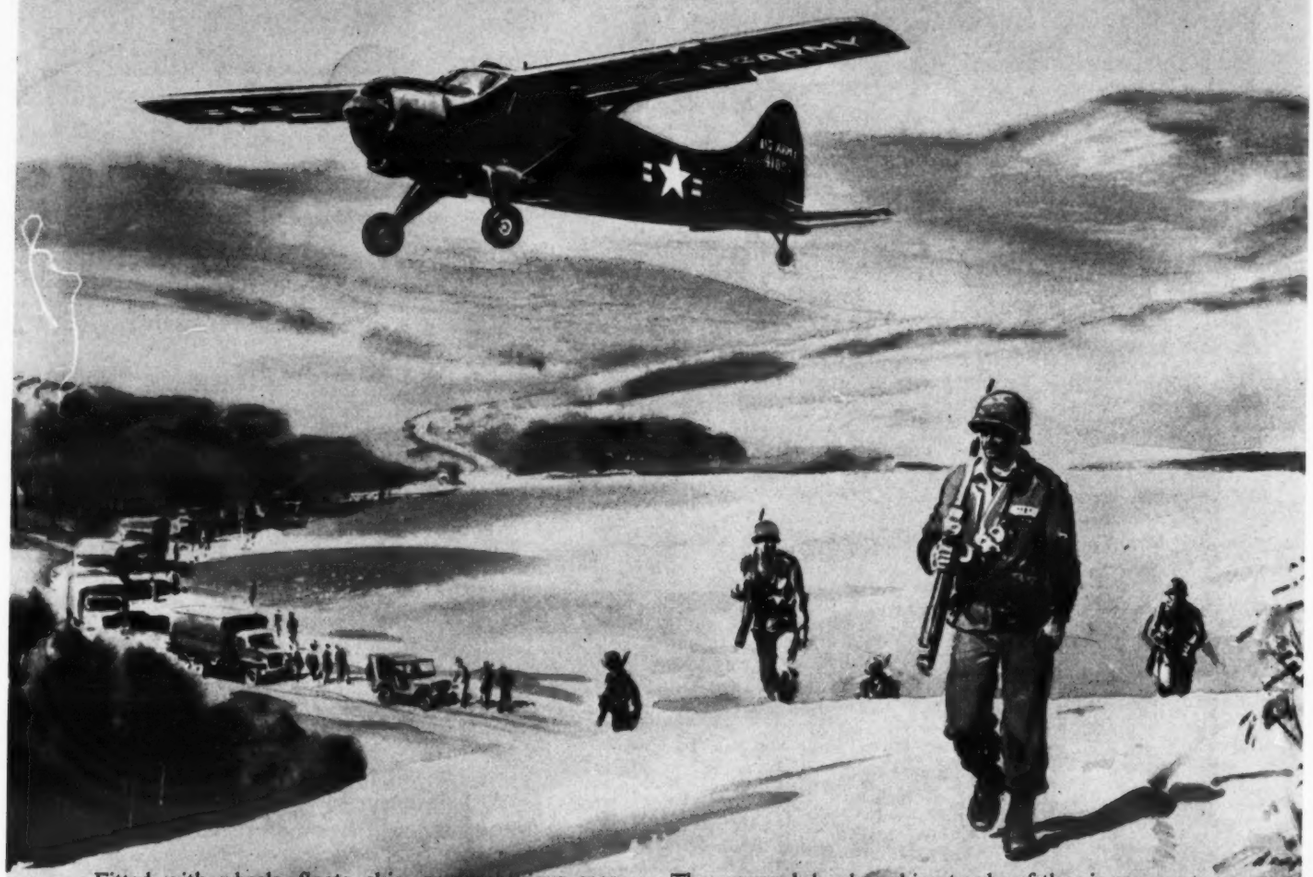
BOEING 707

These airlines already have ordered 707s :

AIR FRANCE - AIR INDIA - AMERICAN
B.O.A.C. - BRANIFF - CONTINENTAL - LUFTHANSA
PAN AMERICAN - QANTAS - SABENA - TWA

1,000 Beavers are in service

More than a thousand Beavers are now in service, their bases spread over the seven continents. They operate in every extreme of climate and in a wide diversity of civil and military roles.



Fitted with wheels, floats, skis, or amphibious gear, they operate from small airstrips, lakes or rivers. (The landplane take-off run is less than 600 feet.)

These rugged, hard-working trucks of the air can carry six passengers, or over half-a-ton of freight, for a distance of five hundred miles.

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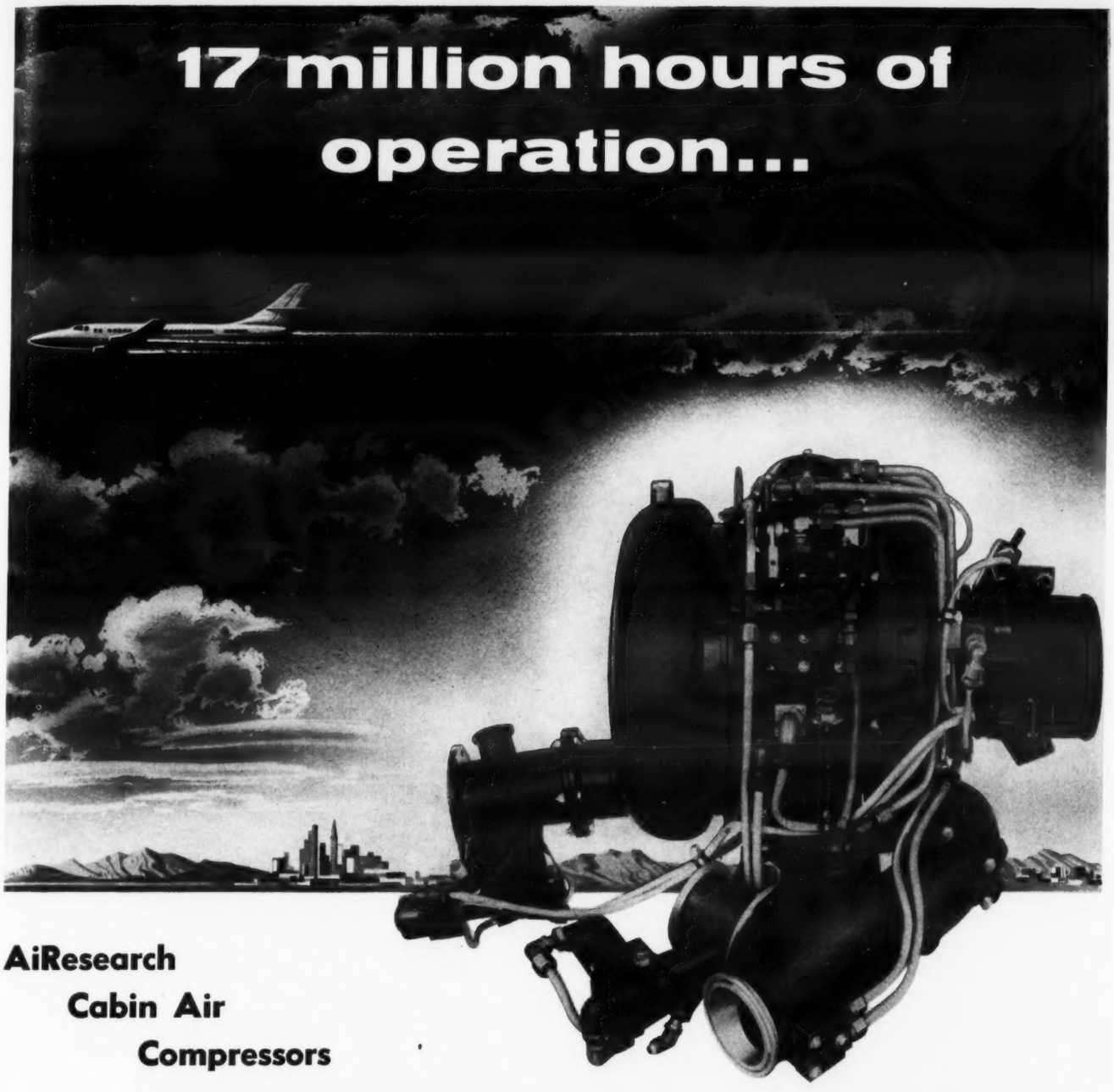

AiResearch Cabin Air Compressors

Latest designs will soon appear on the most modern turbojet (unit shown) and turboprop air transports

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Captains for a Voyage into the Unknown

New Men in the Pentagon

" Changing of the guard ", " personnel reorganization ", " reshuffle among generals " . . . the journalists have dozens of hackneyed expressions to describe the situation when military administration and supreme command pass into new hands. But this time such slogans are of little use. What has really taken place in the United States Defense Department, the U.S. Air Force and the Joint Chiefs of Staff is much more than the appointment of new men to old posts. The Secretaries and Generals appointed by President Eisenhower at the end of March 1957 will have the task of steering the U.S. defence organization into the unknown. They are expected to furnish the requirements for robot warfare.

The transition from manned aircraft to guided and ballistic missiles, from chemical to atomic explosives, is taking place at top speed. Whereas missiles accounted for only 8.2% of the three services' procurement programme in 1955, they already claim 38.5% in the 1957-58 budget, and the aircraft industry expects their share to rise to 60 or 70% in 1960-61. In view of these figures, no shadow of doubt remains : a large portion of present weapons is destined for the museum.

Who are the men to whom the new planning has been entrusted ? Significantly, aviation experts have been chosen for the key positions. Incidentally, this is a trend that is not restricted to the United States. It will be recalled that Air Force General Lauris Norstad took over command of the N.A.T.O. forces in Europe a year ago, and that the Chairman of the British Chiefs of Staff Committee is Marshal of the Royal Air Force Sir William F. Dixon.

The new " Who's Who " in the Pentagon is as follows :

For the time being, Charles E. Wilson remains as Secretary of Defense. But it is no secret that the authorities have been on the look-out for a successor to him for several months. The candidate more and more frequently mentioned as likely to be chosen is *Donald Aubrey Quarles*, whom Eisenhower has already advanced from Secretary of the Air Force to Deputy Secretary of Defense.

Quarles neither has political ambitions, nor does he see in his present post a jumping-off ground for a well-paid job in industry. Now 61, he receives from his former company, Bell Telephone Laboratories, an annual pension of roughly $10,000, so that he is not moved by material considerations. His interests lie in the scientific field (he is a missiles expert), and his diplomatic ability has already been demonstrated through his part in smoothing over the differences between the three services. Significantly, he voluntarily reduced the Air Force estimates by $5,000,000,000 during the recent budget debate.

James Henderson Douglas (58), hitherto Quarles' deputy, has been appointed Secretary of the Air Force. Originally an attorney, he became a Colonel in the Air Transport Command during World War II, then took a position in industry and later acted as Assistant Secretary to the Department of the Treasury. Friendly, though at the same time a trifle reserved, he has high personal qualities and is well liked by Congress.

General Nathan F. Twining (59) has risen from Chief of Staff of the Air Force to Chairman of the Joint Chiefs of Staff, in succession to Admiral Arthur E. Radford, who had held the post for two tours of duty, so that reappointment for a third term would have been unwise for political reasons. General Twining joined the Army Air Corps in 1923, was Chief of Staff of the Allied forces in the South Pacific and later Commander of the 15th Air Force in the Italian theatre during World War II. Although he has always keenly advocated modernization of the Air Force, he is esteemed by all three services for his calm and judgment.

General Thomas Dresser White (55), hitherto Vice Chief of Staff of the Air Force, succeeds General Twining as Chief of Staff. A former liaison officer between the Air Force and Congress, and previously Military Attaché to Italy, Russia and China, General White speaks five foreign languages.

General Curtis E. LeMay (47), appointed Vice Chief of Staff of the Air Force, needs no introduction to *Interavia* readers. Under his control, Strategic Air Command, which he has commanded for eight years, has developed into the world's most powerful instrument of globa-strategy.

As regards the other services, *Admiral Arleigh A. Burke* remains for the time being Chief of Naval Operations, and *General Maxwell D. Taylor* continues as Army Chief of Staff. The same applies to *Wilber M. Brucker*, Secretary of the Army, but Secretary of the Navy Thomas S. Gates has retired and been replaced by his former deputy, *William B. Franke*.

Although these appointments do not como into effect until August, when the budget debates will have been concluded, it may be assumed that the influence of the new men will make itself felt during the not altogether uneventful discussions centring around the 1957-58 defence budget.

Donald A. Quarles, Deputy Secretary of Defense.

James H. Douglas, U.S. Secretary of the Air Force.

General Nathan F. Twining, Chairman of the Joint Chiefs of Staff.

General Thomas D. White, Chief of Staff of the Air Force.

General Curtis E. LeMay, Vice Chief of Staff of the Air Force.

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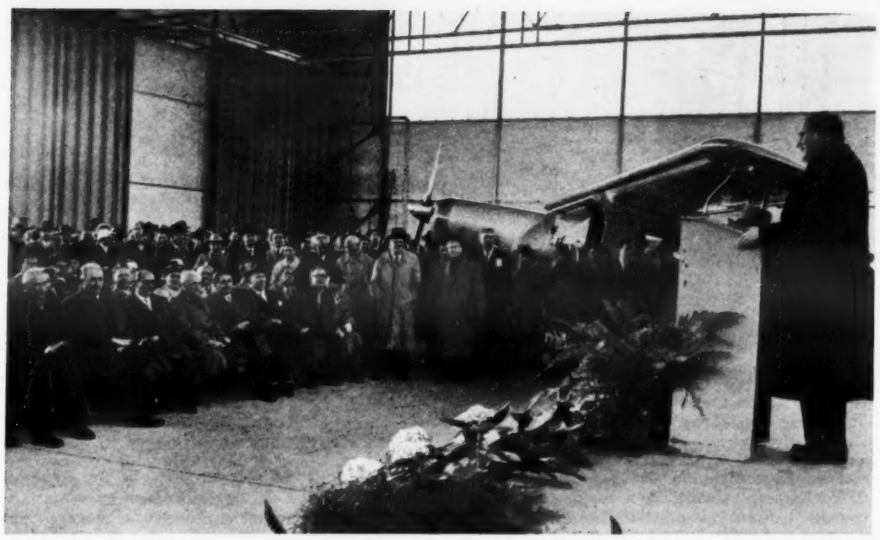
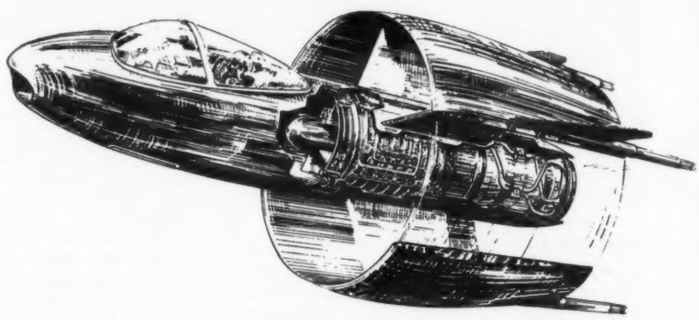
The Annual Congress of W.G.L. and D.V.L. in Essen

From April 9th to 12th 1957



Professor L. Brandt delivering his welcoming address during the official inauguration of D. V. L.'s new aircraft hangar In the rear the Dornier Do.27, the first all-metal aircraft built by German designers since the war, for up to five persons (270 h.p. Lycoming engine). Photo: H. Wiesemann, Düsseldorf.



Vision of the future: manned (and armed) SNECMA-Zborowski coleopter with *Atar* jet in a supersonic climb after a vertical take-off.

From April 9th to 12th the Joint Annual Congress of the " Wissenschaftliche Gesellschaft für Luftfahrt " (W.G.L., Society for the Aeronautical Sciences) and the " Deutsche Versuchsanstalt für Luftfahrt " (D.V.L., German Aeronautical Research Institute) was held in Essen-Ruhr, the metropolis of Germany's largest industrial region. It was attended by more than 1,000 aeronautical scientists and engineers, including 120 foreigners. Among prominent visitors from abroad were Professors Theodore von Karman (AGARD, Paris), Maurice Roy (ONERA, Paris) and Hendricus J. van der Maas (Delft), as well as the following engineers and industrialists : G.W.H. Gardner, Director of the Royal Aircraft Establishment, Farnborough ; B. Shenstone, Chief Engineer of B.E.A., London ; Dr. G. V. Bull, CARDE, Quebec ; H. Desbruères, Managing Director of SNECMA, Paris ; R. Lucien, Chairman of Messier, Paris ; and R. R. Dexter, Secretary of the I.Ae.S., New York. This list lays no claim to completeness, and if one or other major name is omitted, this should be understandable in view of the presence of more than 1,000 guests. For the first time visitors from Eastern Europe took part in a West German Meeting, namely, Professors Brunolf Baade, Dresden ; Gerhard Cordes, Dresden ; and Wladyslaw Fiszdon, Warsaw ; as well as a round dozen aircraft engineers from Eastern Germany.

Professor H. Blenk, President of W.G.L., inaugurated the Congress in the main hall of the Essen Municipal " Saalbau ". In addition to expressions of welcome and gratitude for assistance already received, he appealed to the Federal and Provincial authorities to lend greater support to German aeronautical research in future than had been the case hitherto. If German aeronautical research was to be enabled to solve its tasks, it would require at least DM 50,000,000 a year, as well as more confidence from those supplying these funds, in other words, less bureaucratic red tape. Blenk was followed by Dipl. Ing. K. Frydag, Chairman of the Executive Committee of D.V.L.; Fritz Steinhoff, Prime Minister of the Land Nordrhein-Westphalia ; W. Nieswandt, Lord Mayor of Essen ; and Prof. Dr. Ing. K. Leist, Aachen. Subsequently the new installations of D.V.L. at Essen-Mülheim were inaugurated, the welcoming address being delivered by Secretary of State Professor Leo Brandt. On this occasion it was disclosed that D.V.L. is now operating fifteen institutes and divisions with a total labour force of about 330.

Ranged on both sides of the speakers' forum were the latest creations of German aircraft designers, notably the *Dornier Do 27* 5-seater liaison aircraft and the *Blume 502* 4-seater personal aircraft. Amongst the guests were Lt. Gen. Kammhuber, Commander-in-Chief of the German Air Force ; aircraft designers Prof. C. Dornier, Prof. E. Heinkel, Prof. W. Blume, Prof. K. Thalau, Prof. H. Hertel, Prof. G. Madelung and Prof. B. Baade, as well as Field-Marshal (retd.) Erhard Milch and Major-Gen. (retd.) Adolf Galland.

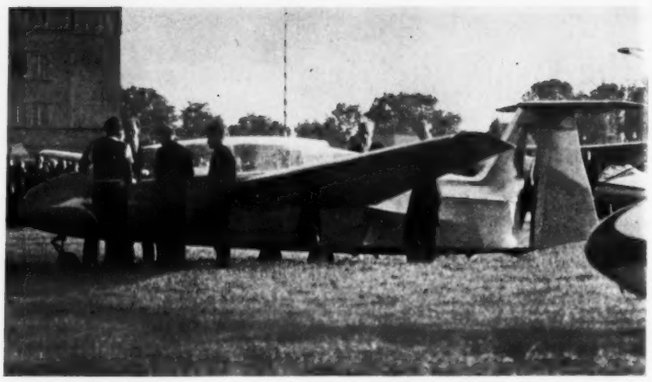
*

Of the total of sixty technical papers, all of which were read at the extremely well appointed " House of Engineering " (" Haus der Technik ") at Essen, mention should be made especially of those which disclose new progress in the fields of aerodynamics, gas dynamics and power plant research. Particular attention should be paid to the lecture by *Dr. G. V. Bull* (Quebec) on Aeroballistic Ranges, which contained interesting details of American methods to determine stability, aileron power coefficients and damping-in-roll coefficients of free flying models in the Mach 0.4 to 15 range. In some cases thin paper membranes were stretched across the test tunnel at several points, which enabled the flying attitudes of the models to be reconstructed from the location of the points of penetration.

Under-Secretary of State Prof. L. Brandt (centre) and D.V.L. Second Chairman Prof. H. Ebner (far left) welcoming prominent guests in the new D.V.L. hall at Essen-Mülheim ; Field-Marshal (retd.) E. Milch (foreground); President R. Lucien (with dark hat).

Lieutenant-General Kammhuber, Head of Section VI (Air Force), Federal Defence Ministry, at the opening ceremony.

Raab *Motorraab* two-seater with 40 h.p. Porsche engine (mixed construction).



Rhein-West-Flug RW.3, a two-seater with 65 h.p. Porsche engine and pusher propeller (all-metal construction).

Prof. E. Naumann, of the Aachen Institute of Technology, then gave a brief description of the new supersonic wind tunnel of the D.V.L. Institute of Applied Gas Dynamics at Aachen. The tunnel operates intermittently by means of compressed air which during the waiting periods is stored in twenty-four high-pressure bottles. The stored air (of 3,600 p.s.i. = 250 atm initial pressure) is expanded approx. to 700 p.s.i. = 50 atm by means of a valve and then flows through a heater which increases its temperature to about 560°C (for measurements at Mach 3), whereupon it is allowed to exhaust vertically upwards through a Laval nozzle. The diameter of the measuring free jet is 8.7 ins. (22 cm), the air flow rate 120 lbs./sec. (55 kg./sec.), the measuring time about 25 secs. At the end of his address Prof. Naumann displayed excellent stria photographs of supersonic air flows on several models, taken at an exposure time of one-millionth of a second.

Dipl. Ing. H. Borsdorff and *Engineer A. M. Desmazes* of SNECMA, Paris, reported on " flying test beds " for jet engines, particularly on the equipment of the SE.2060 " Atar-Armagnac " and the SO.30 " Atar-Bretagne ". *Prof. O. Lutz* (Brunswick), studied the possibilities of thrust augmentation of jet engines by means of gas dynamic mixing processes with the help of simplified graphical calculations. Special interest and a lively discussion were aroused on the last day by a paper read by *Dipl. Ing. E. Söfker* (D.V.L., Aachen), on novel air inlets for jet engines at supersonic speeds. The lecturer showed by means of wind tunnel measurements that it is possible, by mounting an annular nozzle ahead of the cone of a multi-shock intake, to recover 90% of the dynamic pressure of the air flow (at Mach 1.94) ; at the same time a greater continuity of the recovery at the varying flight Mach number and greater immunity to oblique air entry into the engine inlets were noted.

Those participants who attended the conference for its more general interest were satisfied by a series of impressive cinema showings. Displayed were the R.A.E. film of the *Comet* accident investigation, two SNECMA films on the testing of the " Flying Atar " engine, finally short strips of the Lear F-5 automatic pilot and of the advantages of the R.A.E.-developed autostabilizer in aiming flight to counteract combined yawing and rolling motion (Dutch roll).

*

The Congress was concluded—unfortunately in bad weather and too far away from spectators and photographers—by demonstration flights of the following newly developed German powered aircraft :

● *Dornier Do 27*, 5-seater all-metal high-wing monoplane with a 270 h.p. Lycoming engine for speeds from 32 to 138 knots, a service ceiling of 16,400 ft. (5,000 metres), and a normal range of 470 nautical miles.

● *Rhein-West-Flug RW3*, 2-seater all-metal mid-wing monoplane with a 65 h.p. Porsche engine and a pusher airscrew inset in the vertical fin, for a speed range from 38 to 119 knots, a service ceiling of 17,000 ft (5,200 metres, according to the manufacturers) and a range of 405 nautical miles.

● *Klemm-Bölkow Kl 107A*, 3-seater low-wing monoplane built of wood, with a 90 h.p. Continental engine, for speeds from 43 to 100 knots, a service ceiling of 16,000 ft. (4,900 metres) and a range of 405 nautical miles.

● *Blume 502*, 4-seater all-metal low-wing monoplane, with a 150 h.p. Lycoming engine, for speeds from 43 to 133 knots, a service ceiling of 19,000 ft. and a range of 485 nautical miles.

● *Horten 33*, 2-seater " flying wing " aircraft built of wood, with a 65 h.p. Porsche engine, for speeds from 22 to 81 knots, a service ceiling of 16,400 ft. (5,000 metres) and a range of 405 nautical miles.

● *Stark Turbulent* (French licence), single-seater low-wing monoplane built of wood, with a 30 h.p. Stark engine, for speeds from 38 to 86 knots, a service ceiling of 9,850 ft (3,000 metres) and a range of 270 nautical miles.

● *Raab Motorraab*, 2-seater strut-braced high-wing monoplane of composite construction, with a 40 h.p. Porsche engine, for speeds from 27 to 70 knots, a service ceiling of 11,500 ft (3,500 metres) and a range of 220 miles.

*

Newly elected as Honorary Fellows of W.G.L. were Professors C. Dornier (Zug, Switzerland) and A. Meyer (Cologne). Total membership of W.G.L. now consists of 1,305 individuals and organizations.

Klemm-Bölkow Kl.107A three-seater with 90 h.p. Continental engine (wooden construction).

Designed for military training and communications services: five-seat Piaggio P.149D with 270 h.p. Lycoming engine (all-metal construction).

Synchronous Communications *

J. P. Costas, Consulting Engineer, Advance Engineering, Heavy Military Electronic Equipment Department, International General Electric Company, New York.

On completing his studies at Purdue University and the Massachusetts Institute of Technology, Dr. John P. Costas joined General Electric Company in 1951 and is today consulting engineer for communications systems in the Heavy Military Electronic Equipment Department. He has also served since early 1956 in an advisory capacity to the Assistant Secretary of Defense for Research and Development, as a consultant on long-range military radio communications. During World War II, Dr. Costas was attached to the electronics field service group of the Naval Research Laboratory in Washington, D.C., and in 1944 he entered active U.S. Navy service as a radar officer and instructor on radar and fire control equipment. Editors.

For a good many years a very large percentage of all military and commercial communications systems have employed amplitude modulation for the transmission of information. In spite of certain well-known shortcomings of conventional AM its use has been continued mainly due to the simplicity of this system as compared to other modulation methods which have been proposed. During the last few years, however, it has been felt by many responsible engineers that the increased demands being made on communications facilities could not be met by the use of conventional AM and that new modulation techniques would have to be employed in spite of the additional system complexity. Of these new techniques single-sideband has been singled out as the logical replacement for conventional AM.

Many technical reasons have been given to support the claim that SSB is better than AM, and many experiments have been performed which also indicate a superiority for SSB over AM. *We cannot conclude, however, that SSB is superior to AM because we have no assurance whatever that conventional AM systems make efficient use of the modulation process employed.* In fact it could honestly be said that we have been misusing rather than using AM in the past.

Realization of the above situation raises some immediate questions : What are the equipment requirements of an optimum AM system ? How does the performance of the optimum AM system compare with that of SSB ? Which shows the greater promise of fulfilling future military and commercial communications requirements, optimum AM or SSB ?

The optimum AM system

Conventional AM systems fail to obtain the full benefits of the modulation process for two main reasons : inefficient use of generated power at the transmitter and inefficient detection methods at the receiver.

Starting with the receiver it can be shown that if maximum receiver performance is to be obtained the detection process must involve the use of a phase-locked oscillator and a synchronous or coherent detector. The basic synchronous receiver is shown in *fig. 1*. The incoming signal is mixed or multiplied with the coherent local oscillator signal in the detector, and the demodulated audio output is thereby directly produced. The audio signal is then filtered and amplified. The local oscillator must be maintained at proper phase by a feedback control so that the audio output contributions of the upper and lower sidebands reinforce one another.

In spite of its simplicity this type of receiver has several important advantages. To begin with, no *IF system* is employed, which eliminates completely the problem of image responses. The effective use of post-detector filtering allows extreme *selectivity* to be obtained without difficulty (the selectivity curve of such a receiver will be found to be the low-pass filter characteristic mirror-imaged about the operating frequency). Moreover, the selectivity of the receiver may be easily changed by low-pass filter switching. The carrier component of the AM signal is not in any way involved in the demodulation process and need not be transmitted when using such a receiver. Furthermore, detection may be accomplished at very low level and consequently the bulk of total receiver gain may be at audio frequencies. This permits an obvious application of transistors and, more important, allows the selectivity determining low-pass filter to be inserted at a low-level point in the receiver, which aids immeasurably in protecting against spurious responses from very strong undesired signals.

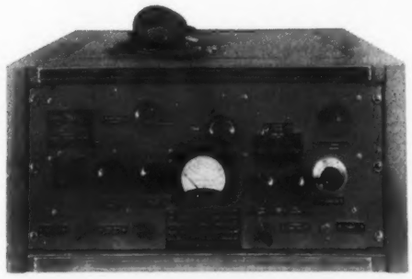
The feedback control (two-phase system) can be modified quite readily to correct for large frequency errors due to doppler shift when receiving AM in air-to-air or ground-to-air links. Interfering signal components which fall within the pass-band of the receiver can be reduced and sometimes eliminated. The true anti-jam characteristics of AM cannot be realized unless a receiving system of the type discussed above is used. Since both synchronization and demodulation are accomplished in complete independence of carrier, suppressed-carrier transmissions may be employed, an opportunity which can be used to good advantage in transmitter design.

One of the more successful methods of generating carrier-suppressed AM signals is shown in *fig. 2*. A pair of class-C beam power amplifiers is screen-modulated by a push-pull audio signal and driven in push-pull from an R.F. exciter. The screens are returned to ground or to some negative bias value by means of the driver transformer center-tap. Thus in the absence of modulation no R.F. output results, and during modulation the tubes conduct alternately with audio polarity change. The circuit is extremely simple, and a given pair of tubes used in such a transmitter can easily match the average R.F. power output of the same pair of tubes used in SSB-linear amplifier service. The circuit is self-neutralizing, and the tune-up procedure is very much the same as in any

* Extract from a report published in the Proceedings of the Institute of Radio Engineers, by permission of I.R.E.

The AN/FRR-48 (XW-1) synchronous receiver for the frequency range from 2 to 32 Mc/s—with intermediate frequency stage — for the reception of standard AM, suppressed-carrier AM, narrowband FM, phase modulation and undamped unmodulated waves (CW).

The AN-FRT-49 (XW-1) suppressed-carrier AM transmitter. The final stage uses a pair of 6146 tubes. Peak sideband power output for continuous sine-wave modulation : 150 watts. The modulator is a single 12BH7 miniature double triode. Frequency : 2 to 30 mc/s



Th AN/FRT-30 (XW-1) suppressed-carrier AM transmitter. Peak sideband power output under continuous sine-wave audio conditions : 1,000 watts. The final tubes are 4-250-As, and the modulator uses a pair of 6L6s. Frequency : 2 to 30 Mc/s.

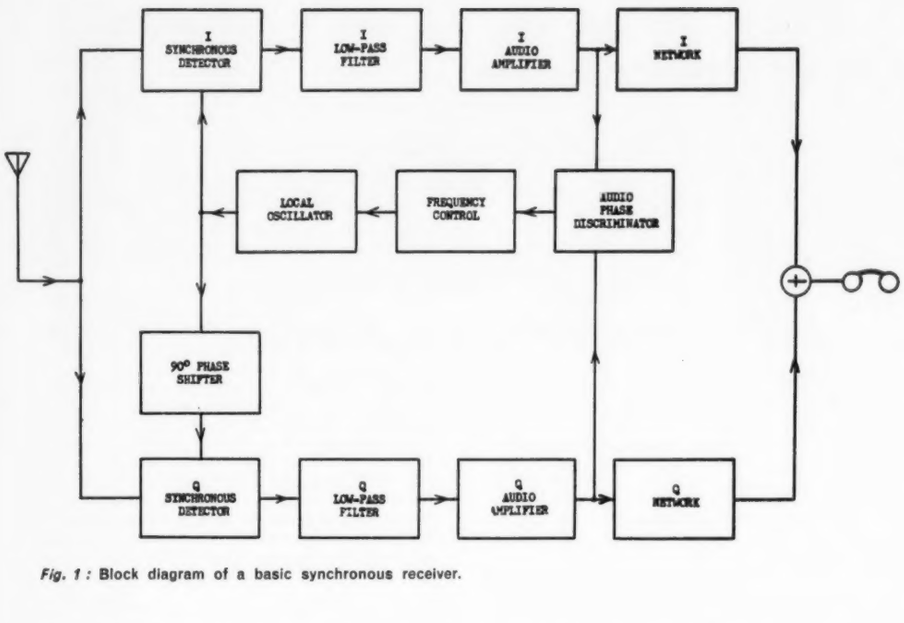


Fig. 1 : Block diagram of a basic synchronous receiver.

other class-C R.F. power amplifier. The excitation requirements are modest ; as an example the order of eight watts of audio are required to produce a sideband power output equivalent to a standard AM carrier output of one kilowatt.

This transmitter circuit is by no means new. The information is presented here to indicate the equipment simplicity which can be realized by use of synchronous AM communications.

A comparison of synchronous AM and single-sideband

It is interesting at this point to compare the relative advantages and disadvantages of synchronous AM and single-sideband systems. Although single-sideband has a clear advantage over conventional AM this picture is radically changed when synchronous AM is considered.

Signal-to-noise ratio : If equal average powers are assumed for SSB and synchronous AM it can easily be shown that identical signal-to-noise ratios will result at the receiver. The additional noise involved from the reception of two sidebands is exactly compensated for by the coherent addition of these sidebands. The 9 db advantage often quoted for SSB is based on a full AM carrier and a peak power comparison. If intelligent jamming rather than noise is considered there exists a clear advantage of two-to-one in average power in favor of synchronous AM.

System complexity : Since the receiver described is also capable of SSB reception it would appear that synchronous AM and SSB systems involve roughly the same receiver complexity. This is not altogether true since much tighter design specifications must be imposed if high quality SSB reception is to be obtained. If AM reception only is considered these specifications may be relaxed considerably without materially affecting performance.

The suppressed-carrier AM transmitter is actually simpler than a conventional AM transmitter and far simpler than any SSB transmitter. There are no linear amplifiers, filters, phasing networks, or frequency translators involved. Personnel capable of operating or maintaining standard AM equipment will have no difficulty in adapting to suppressed-carrier AM. The military and commercial significance of this situation is obvious.

Long-range communications : The selective fading and multipath conditions encountered in long-range circuits tend to vary the amplitude and phase of one sideband component relative to the other. This would perhaps tend to indicate an advantage for SSB, but tests to date do not confirm this. Synchronous AM reception of standard AM signals over long paths has been consistently as good as SSB reception of the same signal.

Spectrum utilization : In theory single-sideband transmissions require only half the bandwidth of equivalent AM transmissions and this fact has led to the popular belief that conversion to single-sideband will result in an increase in usable channels by a factor of two. In reality there are many factors which determine frequency allocation besides modulation bandwidth.

To begin with, the elimination of one sideband is a complicated and delicate business. Any one of several misadjustments of the SSB transmitter will result in an empty sideband which is not actually empty. We are not thinking here of a telephone company point-to-point system staffed by career personnel but rather we have in mind the majority of military and commercial field installations. This is in no way meant to be a criticism, but the technical personnel problem faced by the military especially in time of war is a serious one and cannot be ignored.

There may be those who would argue that SSB transmitting equipment can be designed for simple operation, but in general operational simplicity can only be obtained at the expense of additional complexity in manufacture and maintenance. This of course trades one set of problems for another. Even if we assume ideal SSB transmission, we are still faced with an even more serious allocation problem, that of receiver non-linearity, which becomes a dominant factor when trying to receive a weak signal in the presence of one or more near-frequency strong signals. Under such conditions the single-signal selectivity curves often shown by manufacturers are next to meaningless.

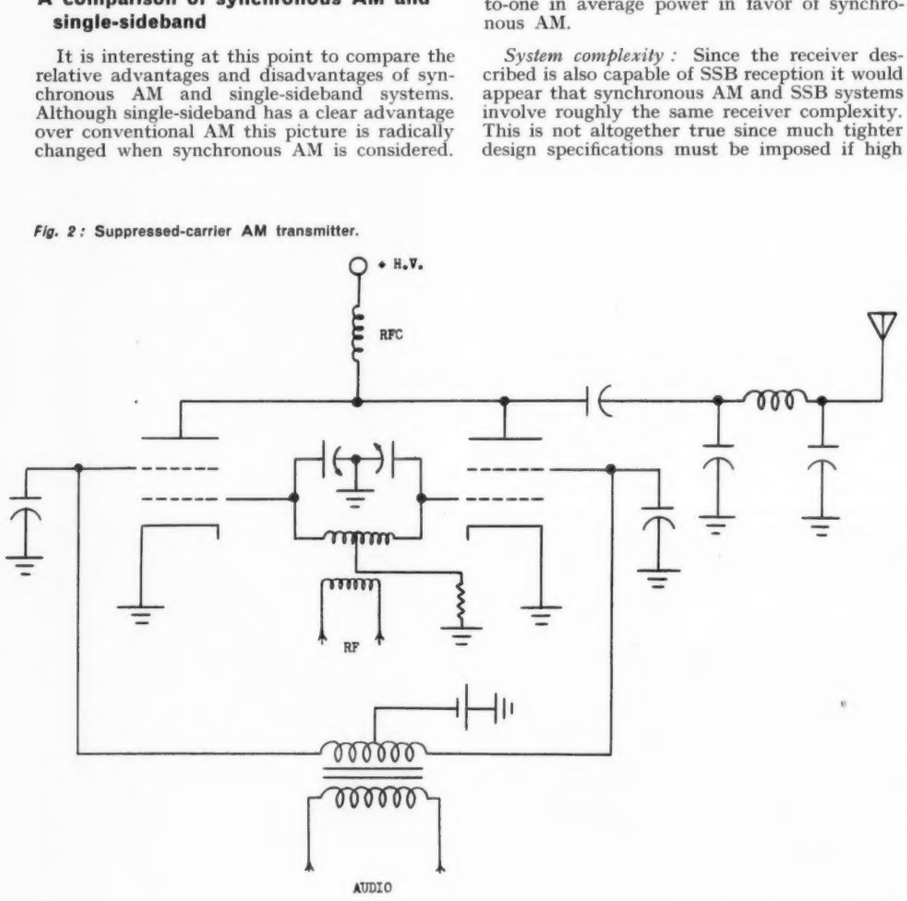
In short the spectrum economies of SSB which exist in theory cannot always be realized in practice, especially in certain military and commercial communications situations.

Jamming : The reduction of transmission bandwidth afforded by single-sideband must be paid for in one form or another. A system has yet to be proposed which offers nothing but advantages. One of the prices paid for this reduction in bandwidth is greater susceptibility to jamming. From a military point of view jamming raises a very serious question. If we concede for the moment that by proper frequency allocation single-sideband offers a normal channel capacity advantage over AM, what would happen to this advantage if communications became unintelligible ?

■

There is an undeniable need for improved communications, and to date it appears that single-sideband has been almost exclusively considered to supplant conventional AM. *It has been the main purpose of this paper to point out that the improved performance needed can be obtained in another way. The synchronous AM system can compete more than favorably with single-sideband when all factors are taken into account.*

Fig. 2 : Suppressed-carrier AM transmitter.



A New Method of Geological Survey

The aircraft is being used to an increasing extent for jobs that have no relation to passenger or freight transportation or military purposes. One of these jobs is aerial survey work, which is now bringing its operators an annual turnover of around $18,000,000.

Whether it be the mapping of Haiti from the air, studying automobile traffic patterns in Los Angeles or finding a new copper deposit in Canada or more iron reserves in South Africa, the task can be completed by an aircraft carrying a variety of cameras, nuclear and electronic equipment.

*

One American company engaged in this work is *Hycon Aerial Surveys, Inc.*, which has recently added a complete airborne geophysical division to its established aerial photography business. The new division also uses a number of new geophysical tools.

These tools include the *Varian nuclear precession magnetometer* for measuring changes in intensity of the earth's magnetic field. By using the properties of the proton [1], measurements are given a hitherto unobtainable accuracy. The instrument locates iron ore deposits and helps to find commercial ores such as copper, lead, zinc and nickel [2]; it is also used to determine the geological structure of oilfields.

This and other instruments were installed in a *Catalina* flying boat *(picture)*, transforming it into a veritable flying geophysical laboratory carrying more than a ton of sensitive electronic equipment. An aircraft so outfitted can cover 100 square miles a day. Thus a whole area or country can be surveyed in a matter of months, instead of the years required for a survey of this type on the ground.

The *flying electromagnetic system* works on the following principle: an electric current is fed through a large triangular-shaped coil on the aircraft *(see diagram)*, generating an electromagnetic field. If the aircraft flies over an electrical conductor such as a copper deposit, this field causes a secondary electromagnetic field to be generated in the ground. A detector head is lowered from the aircraft to pick up the signal indicating the presence of copper, nickel or lead ores. The aircraft cruises at 500 ft., and a 35-mm camera constantly records its position so as to identify the exact location of any ore deposit detected. The crew of five comprises pilot, co-pilot, flight engineer, navigator and instrument operator.

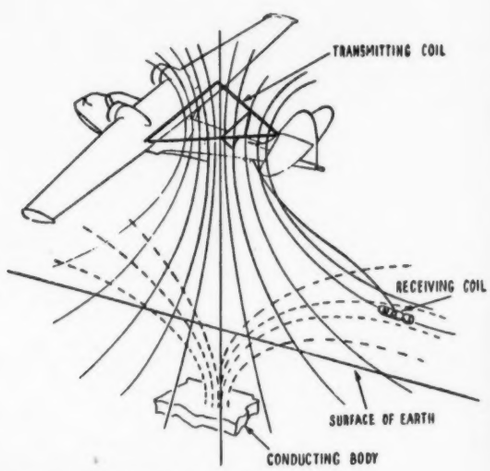
In uranium prospecting from the air, Hycon uses an airborne *scintillation counter*, which records—separately but simultaneously—the radiation from uranium, thorium and potassium. This, too, is a new development, since hitherto airborne scintillometers recorded only the total radiation.

If only the Varian magnetometer is used, it can be fitted in a single-engine Cessna 195, to reduce cost for the small miner or independent oil man. In this case, the coil is installed in a streamlined housing and towed along on a cable *(picture)*.

*

Some of the world's largest mines are located on plots of ground covering only some 200 acres in the roughest terrain. Here the helicopter offers substantial advantages for aerial survey.

A Hycon Aerial Surveys Cessna 195 : with a Pratt &Whitney 450 h.p. engine in place of the normal 300 h.p. power unit, a service ceiling of around 26,000 ft. is obtained. With the Cessna's manœuvrability and high ceiling, photographs can be taken from high altitude, and geophysical surveys made in low flight.

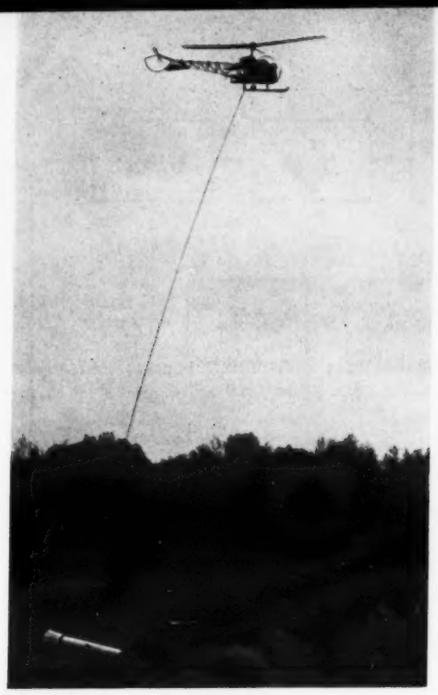


Electromagnetic methods for ore prospecting.

The PBY *Catalina* flying boat which Hycon transformed into a flying geophysical laboratory.

[1] The proton is an elemental particle of all atoms. In particular it forms the nucleus of the hydrogen atom, from which it can be obtained by ionization, i.e., removal of the electron.

[2] These minerals are often associated with magnetic minerals.



Bell 47-G2 and " bird " on the job.

Aerial survey equipment for the Bell 47-G2 helicopter ... a 20-ft. " bird ".

Hycon has therefore equipped a *Bell* 47-G2 helicopter *(picture)* with a magnetometer, scintillometer and electromagnetometer—having previously solved some tough weight problems. For example, the weight of the magnetometer was successfully cut to 80 lbs, without sacrificing accuracy or reliability. The transmitting and receiving coils for the electro-magnetometer were mounted in a 20-ft. "bird" which trails on a 100-ft. cable within 50 ft. of the ground. The " bird " is constructed of doped cloth and fibreglass.

*

During the past two years, Hycon Aerial Surveys Inc. has completed survey projects in Alaska, Spain, the Philippines, Mexico, Haiti, Colombia, Peru, Ecuador, Bolivia, Chile and Africa. It is estimated that so far only about one third of the earth's surface has been photographed and a far smaller portion adequately surveyed for natural resources. Thus the outlook for aerial survey enterprises would appear to be definitely rosy.

Aircraft Radio Corporation's Type 21 Automatic Direction Finder

Light and small, and modernized in every way to meet present-day requirements for CAA type certification and the military environmental tests, describes Aircraft Radio Corporation's Type 21 Automatic Direction Finder. Although the first production unit came off the line in June, 1956, over 700 had been sold by December, 1956, and approximately 500 delivered.

The set, which took ARC engineers two years to develop, weighs under 20 pounds complete with all five units shown in the diagram (Receiver, Control Unit, Indicator, Loop, Power Unit). Total power drain of the ADF-21 is 2.8 amp with a 28 V primary supply. From a 14 V supply, it draws 5.6 amp. Both figures include the current drain of its power unit.

Operationally, ARC's ADF has an operational control not previously used on ADF's, a loop-slewing switch that lets the pilot rotate the loop to check the set's automatic function.

The military and foreign version of the Type 21 contains provision for a BFO (beat frequency oscillator) for reception of CW identification signals not normally necessary in North America, and also provision for aural reception in the " Loop Only " position. The latter function is not nearly so necessary now in North America as it was 15-20 years ago when VHF navigation facilities were almost non-existent. Use of the " Loop Only " feature sometimes aids reception under heavy p-static conditions and improves reception of 4-course low frequency range signals under these conditions. It is also a safety factor in case the ADF sense antenna is lost by icing. The pilot may use the Type 21 to obtain a precise bearing by means of an aural null as he swings the loop by means of a left-right toggle switch.

The L-11 loop extends only 1 ¾ inches from the aircraft skin. Its steam-lined housing extends a maximum of 2 inches. For mounting the loop in the aircraft an oval hole 3 ¼ ins. by 6 ins. suffices.

The set has two modes of operation : Antenna and Compass.

In Antenna, it acts as a highly sensitive and selective superheterodyne receiver. A low i-f, 142.5 kc, allows continuous coverage from 190 to 1750 kc, with no tuning gaps for intermediate and nearby frequencies. Other advantages of the low i-f are that it is less susceptible to spurious responses and that it is inherently better from the selectivity standpoint.

When the set is switched to Compass, the loop and modulator circuits are cut in. The loop signal, after being amplified and properly phase-shifted, is applied to the grids of the dual triode in phase; the 100 cps is applied 180 degrees out of phase. With this arrangement, the tube passes the modulation components but suppresses the r-f carrier of the loop signal.

The modulated output is combined with the voltage induced in the sense antenna to produce an amplitude-modulated resultant signal. As the loop is rotated through a null, the phase of the modulated envelope reverses relative to the phase of the modulation source. The envelope is detected and applied to the control winding of the two-phase induction motor that drives the loop.

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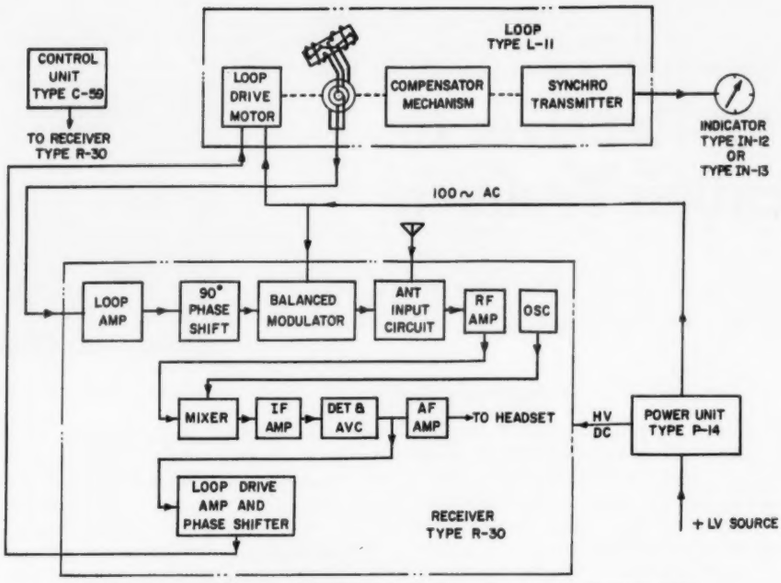
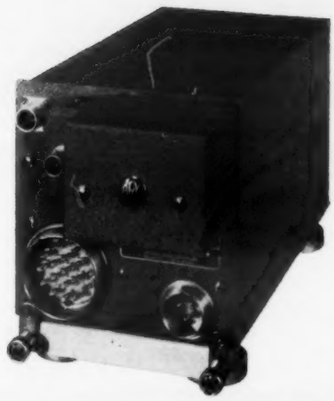


Circuit diagram of the Aircraft Radio Corporation Type 21 automatic direction finder.



The R-30 receiver (above) is part of the ARC Type 21 automatic direction finder and weighs 6.5 lbs complete with shock mounting. The P-14 power unit (below) consumes 2.8 amps. from an input of 27.5 Volt D.C. and supplies all necessary D.C. and A.C.

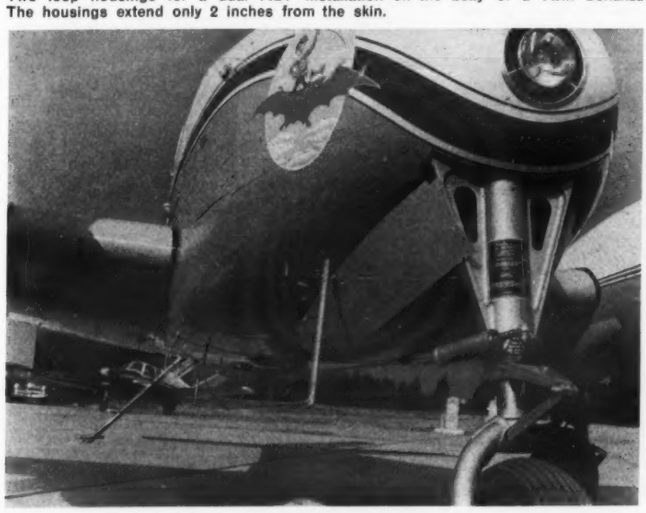
The C-59 control unit shows only one of the three frequency scales which cover the range from 190 kc/s to 1,750 kc/s. The unit is 5 ¾ ins. wide, 3 ¾ ins. high and 2 $^{7}/_{16}$ ins. deep. *Right*, the dual indicator for the ARC Type 21 ADF.

The fixed phase winding of the motor is energized by the 100 cps voltage from the power unit. Because of the phase change of the control voltage, the drive motor reverses direction at the null.

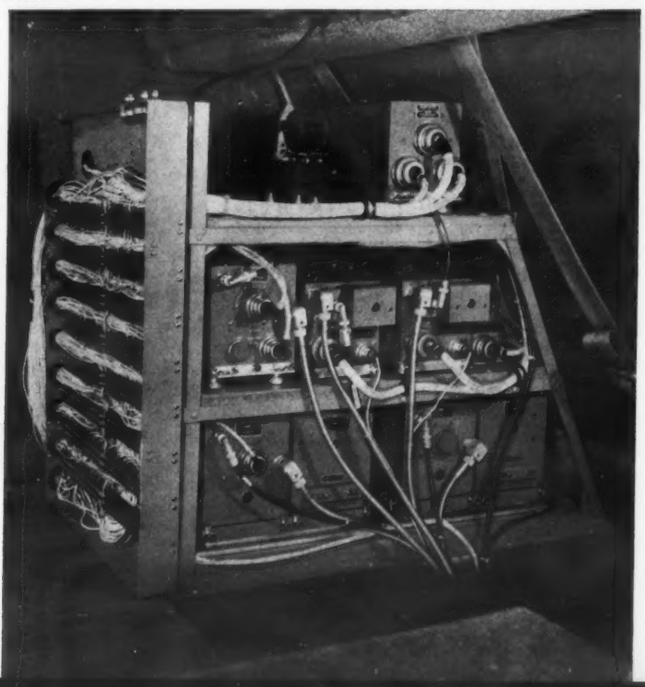
Its overall philosophy in designing the 21, ARC says, was to build an ADF that was light and small but one which would make use of all modern component parts that had definitely proven themselves, and at the same time to take a step forward in the performance characteristics such as an increased distance range. Reports indicate 50 to 100% increase in distance coverage compared with older designs. Parts were made smaller so far as was consistent with reliability. In the physical layout, extreme compactness was secondary to parts accessibility and quality.

The ADF-21's characteristics make it attractive for a great variety of aircraft, small and large. Among military planes, it is especially suitable for jet fighter types.

Two loop housings for a dual ADF installation on the belly of a *Twin Bonanza*. The housings extend only 2 inches from the skin.



Part of the communications and navigation equipment in the *Twin Bonanza*. The middle shelf contains the dual ADF installation, and the lower shelf a dual VOR/localizer receiver installation, ARC Type 15D. The remaining equipment comprises a VHF communications system, dual ARC Type CD-1 Course Director for use with the VOR/localizer receiver, isolation amplifier, cockpit speaker amplifier, marker beacon receiver and glide slope receiver.



New VHF Transmitter-Receiver to Ease Air Communication Problem

Paul O. Momenteller,
Commercial Sales Manager, LearCal Division, Santa Monica, California.

In many busy airports throughout the United States, communications between aircraft and the ground are rapidly becoming unsatisfactory. Most pilots recognize the enormous rise in air traffic as its primary cause. This increased traffic has congested VHF communications to the point where they are confused and often hazardous. The problem is further multiplied by the fact that the usable VHF band assigned to civil aviation is decidedly narrow and restricted, extending from 108 to 132 mc in the VHF frequency spectrum (table 1). Great relief resulted from reducing channel separations from 200 kc to 100 kc in August 1956. Nevertheless, congested air traffic areas still encounter difficulty. For example, a pilot operating on a given frequency in Washington, D.C., often receives interference from the New York ground control.

TABLE 1

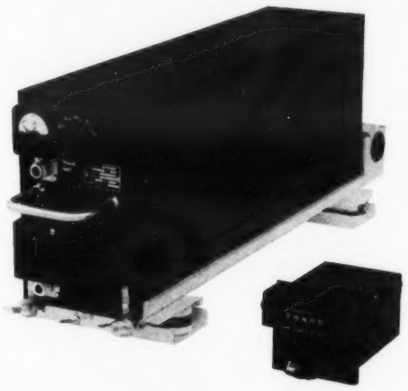
Channel assignment—Aviation VHF Spectrum

Frequencies	Purpose
108.1-112 mc	ILS-TVOR-LVOR
112.1-117.9 mc	Standard VOR
118.1-121.3 mc	Air traffic control communications
121.5 mc	Emergency
121.7-121.9 mc	Airport utility
122.1-122.7 mc	Private aircraft
122.8 mc	Aeronautical advisory stations
122.9 mc	Private aircraft
123.1-123.5 mc	Flight test, flying schools
123.7-126.5 mc	Air traffic control communications
126.7 mc	Aircraft to airways stations
126.9-131.9 mc	Air carriers en route
132-144 mc	Government
144.1-148 mc	Amateur
148.14 mc	Civil Air Patrol

Interference relief

It is unlikely that the frequency range allotted to civil aircraft will be extended. Therefore, interference relief will probably result from: first, further reduction in channel separation and, second, general acceptance of simplex or cross-channel operation.[1] Further reduction in channel separation—down to 50 kc—is expected by 1958. This in itself will double the number of channels now available. Adoption of simplex operation will allow ground control to transmit to all aircraft on one frequency without interference while all aircraft transmit on another.

Future as well as present requirements motivated Lear Inc., Santa Monica, California, to design the LTR-800 VHF transmitter-receiver. The LTR-800, particularly well suited to private and business aircraft, covers the 108 to 147.95 mc range with 800 crystal-controlled frequencies at 50 kc intervals. Developed to meet the demands of high-density air traffic, this communication system answers all the present and future VHF requirements for wider frequency coverage, close channel separation, improved performance and maximum flexibility. The LTR-800 may be operated on as many or as few channels as desired. This necessitates the purchase of only those crystals needed immediately thus allowing low initial purchase cost. Highly compact and lightweight, both the transmitter and receiver are contained in a single, shock-mounted 1/2 ATR rack-sized package weighing less than 25 pounds.



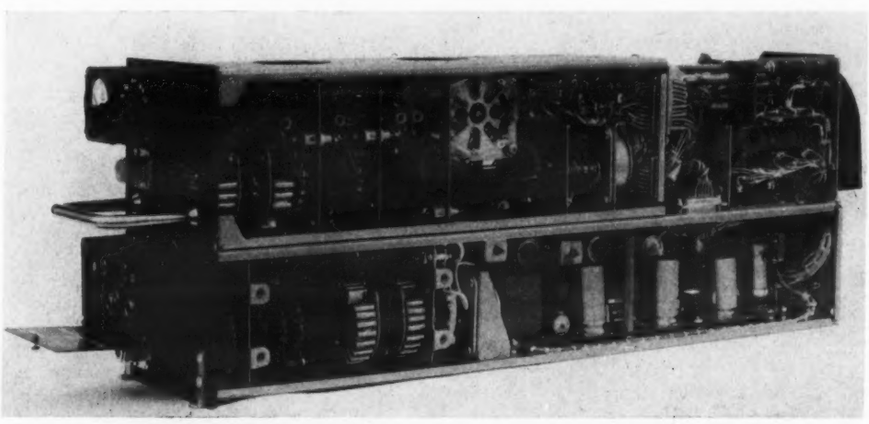
The LTR-800 transmitter-receiver with frequency selector.

To further alleviate air traffic control problems, the LTR-800 may be used for cross-channel as well as simplex operation by the addition of a second control head. In simplex operation, radio transmission and reception are automatically established on the same frequency with a single setting of the frequency selector knobs. With cross-channel operation, one control head selects the transmitting frequency while the second selects the receiving frequency.

Both transmitter and receiver of the LTR-800 are completely independent, except for a common audio amplifier and power supply. All three, transmitter, receiver and power supply, fit into one compact package. Since operation is electrically remote-controlled, no flexible shaft are used. Utilization of three concentric knobs simplifies control head operation.

Receiver features

Included internally in the LTR-800 control head, a separate glide path channel selector switch wafer operates when the receiver is used for ILS approaches. The receiver portion of the LTR-800 is highly sensitive; one microvolt



Inside the compact LTR-800 transmitter-receiver: transmitter top left, receiver bottom, and power unit top right.

[1] Simplex operation means two-way operation on a single channel; cross channel or double channel operation uses two frequencies alternatively, one in each direction.—Ed.

at the antenna terminals delivers 50 mw to a 600 Ohm headset or 500 mw to a 3.2 ohm speaker. Crystal-saving circuits that use combinations of two or more oscillators hold the required number of crystals to a minimum. In this way, only 67 crystals are needed to span the 800 available channels (table 2), though these also need not all be purchased at once. A highly effective automatic noise limiter incorporated in the receiver reduces the amplitude of noise peaks produced by electrical equipment of the aircraft. Receiver design provides for an output signal to energize a separate omni-range accessory. This device gives automatic omni bearing indication and has the necessary filters for localizer and flag alarm presentations.

TABLE 2

Crystals vs channels in LTR-800 receiver

Frequency range	0.1 mc channel spacing		0.05 mc channel spacing	
	Crystals	Channels	Crystals	Channels
118-131.95 mc	25	140	35	280
118-135.95 mc	29	180	39	360
118-147.95 mc	41	300	51	600
108-131.95 mc	35	240	45	480
108-135.95 mc	39	280	49	560
108-147.95 mc	51	400	61	800

TABLE 3

Crystals vs channels in LTR-800 transmitter

Frequency range	0.1 mc channel spacing		0.05 mc channel spacing	
	Crystals	Channels	Crystals	Channels
118-131.95 mc	24	140	34	280
118-135.95 mc	28	180	38	360
118-147.95 mc	40	300	50	600
108-131.95 mc	34	240	44	480
108-135.95 mc	38	280	48	560
108-147.95 mc	50	400	60	800

Transmitter features

Crystal-controlled, the transmitter is capable of an output power in excess of 8 watts, 100 per cent modulated, with clear voice quality. An added feature provides a 5-watt power amplifier for the cockpit loudspeaker to boost the output level of aircraft receivers that have normally only enough volume and power to operate headphones. When not in use as a transmitter, its modulator is available to function as a booster amplifier for the cockpit and cabin speakers.

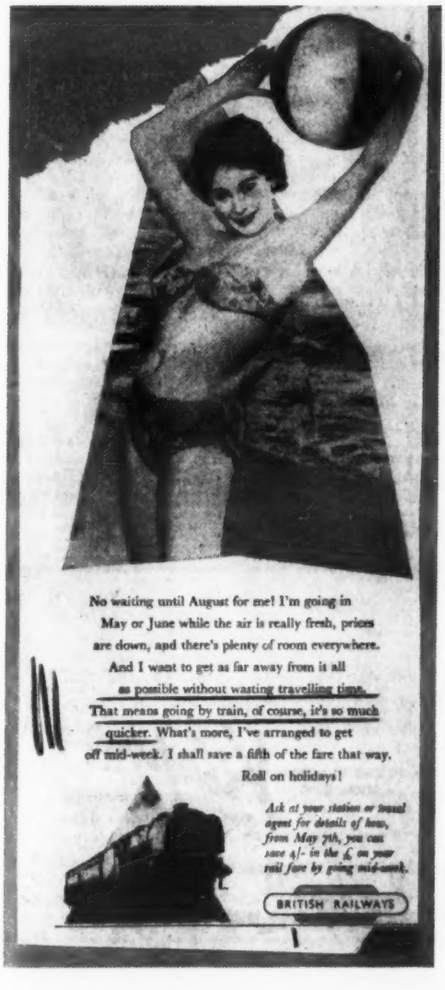
Supplying 800 channels at 50 kc increments from 108 to 147.95 mc, the transmitter seldom, if ever, has to perform in the navigational range (108 to 118 mc). Like the receiver, the transmitter uses crystal-saving circuitry to supply a number of channels far exceeding the number of crystals used (table 3).

With increasing air traffic creating greater communication problems, it is apparent that much of the existing communication and navigation equipment now in use will soon become obsolete or require complete modification. When viewing the VHF channel assignment spectrum, it is clear that reduced channel separation and simplex operation are the only solutions to interference. Together they will provide the means to more extensive and safer communication in our flying future.

TABLE 4

LTR-800 Specs

Rated power:	8 W min. into 51.5 ohms resistive load.
Max. modulation level	(peak modulation by average voice) ninety-five per cent.
Modulation fidelity:	response 300-3,500 cps plus or minus 3 db.
Frequency accuracy:	0.01 per cent.
Power required:	approx. 9 amp, 28 V transmitting; approx. 5 amp, 28 V receiving; approx. 18 amp, 14 V transmitting; approx. 9 amp 14V receiving


No waiting until August for me! I'm going in May or June while the air is really fresh, prices are down, and there's plenty of room everywhere.
And I want to get as far away from it all as possible without wasting travelling time.
That means going by train, of course, it's so much quicker. What's more, I've arranged to get off mid-week. I shall save a fifth of the fare that way.
Roll on holidays!
Ask at your station or travel agent for details of how, from May 7th, you can save 4/- in the £ on your rail fare by going mid-week.
BRITISH RAILWAYS

The Air Hostess Told Us...

Would you please withdraw your head from that thing and say good morning politely, mocks our Favourite Air Hostess, and what are you doing in that suitcase anyway? With dignity we emerge from a heap of shirts and socks and retort severely, Well, if you had any kind of brain you would remember that the Paris International Aviation Show will break out shortly, and so we're getting ready for spring in gay Paree—and you had better do the same.

Me? she says. But I'm not *going. You see—she now tries to blush—I am getting married. Wow, we say, thinking that an atom bomb had exploded in front of our nose, you can't be serious; and you are far too young for that form of suicide. Too young? she replies. I'm not going to wait until the only way I can make a man's heart beat faster is to go and live in a sixth-floor walk-up apartment. Once you've got legs like stovepipes, straight all the way up and down, or thin like Mexican cigars, plus a face like last year's dried apricots, you'll find every man galloping away in all directions, despite my beautiful disposition and lofty ideals. So I'm going to close my eyes and jump.*

Marriage is a change of life, we lecture, but oh boy! you don't know what that expression really means until you've tried it. And who is the unfortunate creature anyway? None of your business, Esmeralda says, you'd only go and discourage him even more, and he's depressed enough as it is. Every morning in the bath he sings that old English classic, "Oh, ain't it grand to be blooming well dead . . . !" I had to use up most of my allure and so much make-up that my face looked like a squashed tomato just to make him lose the idea that a man's time to marry is when he needs a white stick and half a dozen seeing-eye dogs to cross the main street on a zebra crossing at half-past-three in the morning during a traffic strike. My fiancé thinks, reports Esmeralda, that once a man gets completely decrepit, he can always marry a nurse because his looks never count but the pocket book always does.

His ideas are perfectly sound, we tell our Favourite Air Hostess. Take the case of a young bachelor. Of course he may have to pay a housekeeper to make his breakfast, change his sheets, polish his shoes and wax the floors. Now take the case of a young man just married. Not only must he keep his wife, but now he himself must make not one but two breakfasts, change twice as many sheets himself, polish twice as many shoes, finance large numbers of ridiculous hats and dresses every season, roses and diamonds for birthdays and wedding anniversaries which any man would rather not be reminded of. Being happily married simply means that the wife is happy and the husband married. As for children, some ignorants say they are a comfort in old age, but in reality they just get you there quicker.

Well, there may be something in what you say, admits Esmeralda. But men are no angels either, although they pretend to be until they get us where they want to. But as soon as the wedding bells are silent, the gentle, considerate, affectionate, protecting male turns into a strutting peacock, domineering and stingy. So there are two sides to the problem, and what is a sweet young thing like myself to do?

Take "Punch's" advice, we tell her : If in doubt, don't *! And what about Paris ?*

Okay, I'll go to Paris, says our Favourite Air Hostess, and I'm going by rail. You see, British Railways say that not wanting to waste travelling time "means going by train, of course, it's so much quicker . . ."

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Book Reviews

Armee + Wirtschaft—Reprint of a special issue of "Schweizerische Handelszeitung" No. 6, of February 7th, 1957. — Published by Schweizerische Handelszeitung, Zurich, 1957 (German ; 120 pages).

This copiously illustrated reprint, published a few weeks ago, deals with the organization of Swiss defence, in particular with the Arms Programme II (long-term arms procurement programme). Though it discusses primarily Switzerland's defence problems, it also illustrates typical difficulties encountered by all small countries, which must keep pace with rapidly changing tactical and technical advances despite restricted economic resources. — A foreword by Federal Councillor Chaudet, head of the Swiss Military Department, is followed by 26 contributions by leading military and civil personalities from political and economic life, who deal primarily with the economic aspects of armament. The subjects discussed include: "Financing Swiss Defence Expenditure", "The Procurement of Modern Combat Aircraft", "Radar in the Future Air Force", "Efficient Anti-Aircraft Defence", etc. It is to be particularly welcomed that an independent economic periodical should undertake to acquaint the technically untrained reader—who after all has to bear the burden of armaments—with the needs and problems of national defence. Re.

Internationale Luftfahrt-Abkommen, Vol. III. By Alex Meyer. — Carl Heymanns Verlag, Cologne, 1957 (German ; X + 322 pages; price DM 33.80).

An air law expert of international reputation, whose previous writings have included much original work, has here undertaken the less spectacular task of publishing the texts of international air transport agreements, with brief explanatory notes. The first two volumes in the series have already been reviewed in *Interavia*. The third volume contains some particularly important texts: (1) the Chicago Convention of December 7th, 1944 and the transit agreement of the same date, in the original English version and official German translation; (2) the Warsaw Convention of October 12th, 1929 and the Hague Protocol (redraft of the Convention) of September 28th, 1955, in the original French and the official German translation accepted by Germany, Austria and Switzerland; (3) the Anglo-American Bermuda Agreement of February 11th, 1946, which has served as base for all subsequent bilateral agreements, in the original English and a German translation prepared by the Air Law Institute of the University of Cologne. All in all, a book which should not be absent from any aviation library. He.

Luftkrieg und Menschlichkeit. By Dr. Eberhard Spetzler. Vol. 12 in the series of Göttingen contributions to present problems of international law and international relations. (Editors: Institute for International Law, University of Göttingen). — Verlag Musterschmidt, Göttingen, 1956 (German; VIII + 451 pages).

Atomic explosives and long-range missiles have made the problem of protecting the non-combatant population under international law particularly acute. As a pilot, staff officer and legal expert, the author has every qualification for examining these questions. What is more, he has shown remarkable patience in reading through, with critical eye, the mass of literature already printed on the subject. The first part of his very comprehensive monography deals with international agreements, from the Hague Declaration of 1899 to the Geneva Convention of 1949 on the protection of the civil population. The second part examines international common law, but spends perhaps too much time on the question of guilt for the World War II bombing (here it is quite possible to arrive at different conclusions from the author, who cannot always forget that he was a German staff officer). Otherwise a very valuable book, which does praiseworthy preliminary work towards the later codification of the law as applied to air warfare. He.

Turkish Commercial Aviation. By Mieczyslaw A. Budek. Reprint from "The Journal of Air Law and Commerce" for Baker Library, Harvard University — Graduate School of Business Administration. (English; 100 pages.)

Harvard University's Baker Library, founded in 1944, has here provided the public with a concentrated, highly instructive account of Turkey's civil aviation: its political and legal bases; organization; statistical data for ground organization, aircraft industry and air transport. He.

Atomenergie und die Welt von Morgen. By Angelos Angelopoulos. (German edition of "L'Atome unira-t-il le monde ?") — Verlag Musterschmidt, Göttingen, 1956 (209 pages; price DM 12.80).

Interavia can normally give little space to translations. However, an exception is made here since Professor Angelopoulos' book represents a highly welcome attempt to show our politically split world, menaced as it is by the atomic bomb, what decisive progress world economy could achieve by rational, peaceful utilization of nuclear energy. He.

Atmospheric Models (Document No. 56D233 of the Air Force Cambridge Research Center). — Published by the Missile and Ordnance Systems Department of General Electric Company, Philadelphia, 1957 (English; 28 pages; no charge).

This booklet presents in tabular and topological form much valuable information about the upper atmosphere up to 300 km and can be used as an extension to the 20-kilometre I.C.A.O. Standard Atmosphere tables. An introductory main table gives geometric and geopotential altitude (in metres), with temperature gradient, molecular temperature (in degrees Kelvin), kinetic temperature (in degrees Kelvin), real kinetic temperature (in degrees Kelvin), molecular weight (in grammes per molecule), pressure (in millibars). Other tables contain details of sonic speed as a function of altitude (in feet per second), kinematic viscosity (in sq. ft. per second), temperature (in °C, °F, °R) and air density (in lb sec2/ft4) versus geometric altitude and geopotential altitude (in feet), and of the behaviour of electron density (in Coulomb per cubic metre) as a function of altitude (in km). Re.

High Speed Aerodynamics and Jet Propulsion — Volume VII, Aerodynamic Components of Aircraft at High Speeds. — Edited by A. F. Donovan and H. R. Lawrence. — Princeton University Press, Princeton, New Jersey, 1957 (English; 845 pages; price $17.50).

Another volume in the series of books on high speed aerodynamics and jet propulsion edited by Professor Theodore von Karman, Hugh L. Dryden and Hugh S. Taylor (Volumes I, II, VI and IX have already been reviewed in *Interavia*). The present work, written by eight well-known authors, is an excellent example of scientific reporting and can be particularly recommended to design engineers who have to incorporate the latest advances in aerodynamic theory into their practical work. Among the seven chapters, special reference should be made to the 250-page contribution by C. Ferrari (Turin Polytechnic) on wing, fuselage, tail and propeller interaction problems in the subsonic and supersonic ranges, and a report by C. B. Smith (Pratt & Whitney Aircraft Division) on supersonic propellers. — As in all volumes of the series, there is a bibliography—often containing more than 200 titles—at the end of each chapter. Re.

Realities of Space Travel. (Selected Papers of the British Interplanetary Society). — Edited by L. C. Carter. — Putnam Company Limited, London, 1957 (English; 431 pages; price 35 shillings).

Full appreciation must be expressed for the editor's idea of selecting the "realities of space travel" from the wealth of scientific papers on satellite launching, interplanetary travel, biological aspects of space travel, etc. In 24 chapters a number of engineers, physicists, biologists and astronomers return to papers presented during recent years to the British Interplanetary Society. The list of authors includes Dr. L. R. Shepherd, Dr. H. Preston-Thomas, Dr. M. W. Ovenden, Professor S. F. Singer, Dr. W. R. Dornberger, Dr. N. J. Bowman. A thorough survey of space travel technology, from the first beginnings to A. V. Cleaver's detailed programme for an interplanetary journey. Re.

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The Handbook of Rockets and Guided Missiles. — By Norman J. Bowman. — Perastadion Press, Chicago 43, 1957 (printed in manuscript form ; English ; 328 pages ; price $6.50).

A survey of the most important rockets, rocket aircraft and guided missiles so far developed, in more complete form than has ever been published hitherto. The author lists well over a thousand types, in alphabetical order, giving in each case historical notes, some technical data and references to articles in the international technical press. The somewhat sketchy drawings in the appendix, however, do not quite match the carefully prepared text. Re.

Propagation des Ondes Electromagnétiques de Haute Fréquence. — By J. Ortusi. — Société française de Documentation électronique, Paris, 1957 (French ; 320 pages ; price 3,100 French francs).

One of the first French engineers to write on the propagation of high-frequency energy opens with this book the " Collection des Annales de Radioélectricité ». He addresses engineers, technicians and students concerned with problems of HF wave propagation and devotes five chapters to electromagnetic energy, progressive guided waves, propagation in anisotropic media, waveguide branches and propagation around the earth's surface. Na.

Books received

Seitenstabilität und Seitensteuerung. By Dr.-Ing. habil. W. Just, assisted by Dipl.-Ing. X. Hafer, — Verlag Flugtechnik Stuttgart/Ernst von Olnhausen, 1957.

Publications scientifiques et techniques du Ministère de l'Air. — Distributed by the Service de documentation et d'information technique de l'Aéronautique, Paris :

No. 322 : *Etude de la convection par les fils aux faibles nombres de Reynolds*, by Jean Gosse.

No. 323 : *Résolution de divers problèmes du type Stokes-Beltrami posés par la technique aéronautique*, by Pierre Brousse.

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No. N. T. 63 : *Séminaire d'aérothermique de la Faculté des Sciences de Paris*, by Edmond A. Brun.

Polish Academy of Sciences, Quarterly Review of Publications, No. 4, 1956 and No. 1, 1957. — Issued by the Distribution Centre for Scientific Reporting, " Ossolineum ", Warsaw (English).

Combustion and Flame, Quarterly Journal of the Combustion Institute, No. 1, Vol. 1. — Butterworths Scientific Publications, London, 1957 (English ; annual subscription £5 5s. or $16).

Ingilizce - Fransizca - Türkçe, Sivil Havacilik Lûgati (English-French-Turkish dictionary of civil aviation). — Published by Ismail Ismen and Günen Ipekçi, for the Istanbul Technical University, 1956.

Supplement and errata

Supplement : The Editors are pleased to agree to the request of F. G. Miles Ltd., Shoreham, England, that mention should be made of two additional British aircraft that were omitted in the table of " *Aircraft from Europe's Workshops* " (*Interavia*, No. 3, 1957, pp. 210-212). The two aircraft are :

Category 10 : Jet trainers and communications aircraft : 10.12 : Miles M. 100 *Student*, trainer with one Blackburn-Turboméca *Marboré 2* jet engine of 880 lbs static thrust ; span 8.5 m = 28 ft. ; gross weight 1.4 tons ; max. speed 256 knots ; two-seater.

Category 11 : Piston-engined trainers and communications aircraft : 11.16 : Hurel-Dubois-Miles HDM. 105, small transport with Hurel-Dubois high-aspect-ratio wing on Miles-Aerovan fuselage, with two Blackburn *Cirrus Major III* engines of 150 h.p. each take-off rating ; span 23 m = 75.3 ft ; gross weight 2.8 tons ; max. speed 115 knots ; eight-seater. — Forerunner of the HDM. 106 transport (two Lycoming GO-480 engines) and the projected HDM. 107 military transport (two Lycoming propeller turbines).

Major European Wind Tunnels : After publication of *Interavia* No. 3, 1957, the Editors received a corrected list of ONERA wind tunnels, which reveals that the following modifications should be made in Table II on page 240 of the above-mentioned issue :

— Project S.7.LCH has been dropped.

— Tunnel S.3.CH has several one-to-six component balances.

— Tunnel S.5.CH (hitherto designated S.5.LCH) : power 880 CV, instead of 1680 CV as originally reported ; max. Mach No. 2.5.

— Auxiliary tunnel 1, Modane : flow speed Mach 5.

— Auxiliary tunnel 2, Modane : flow speed Mach 5.

— Auxiliary tunnel 3, Modane : flow speed Mach 3.5

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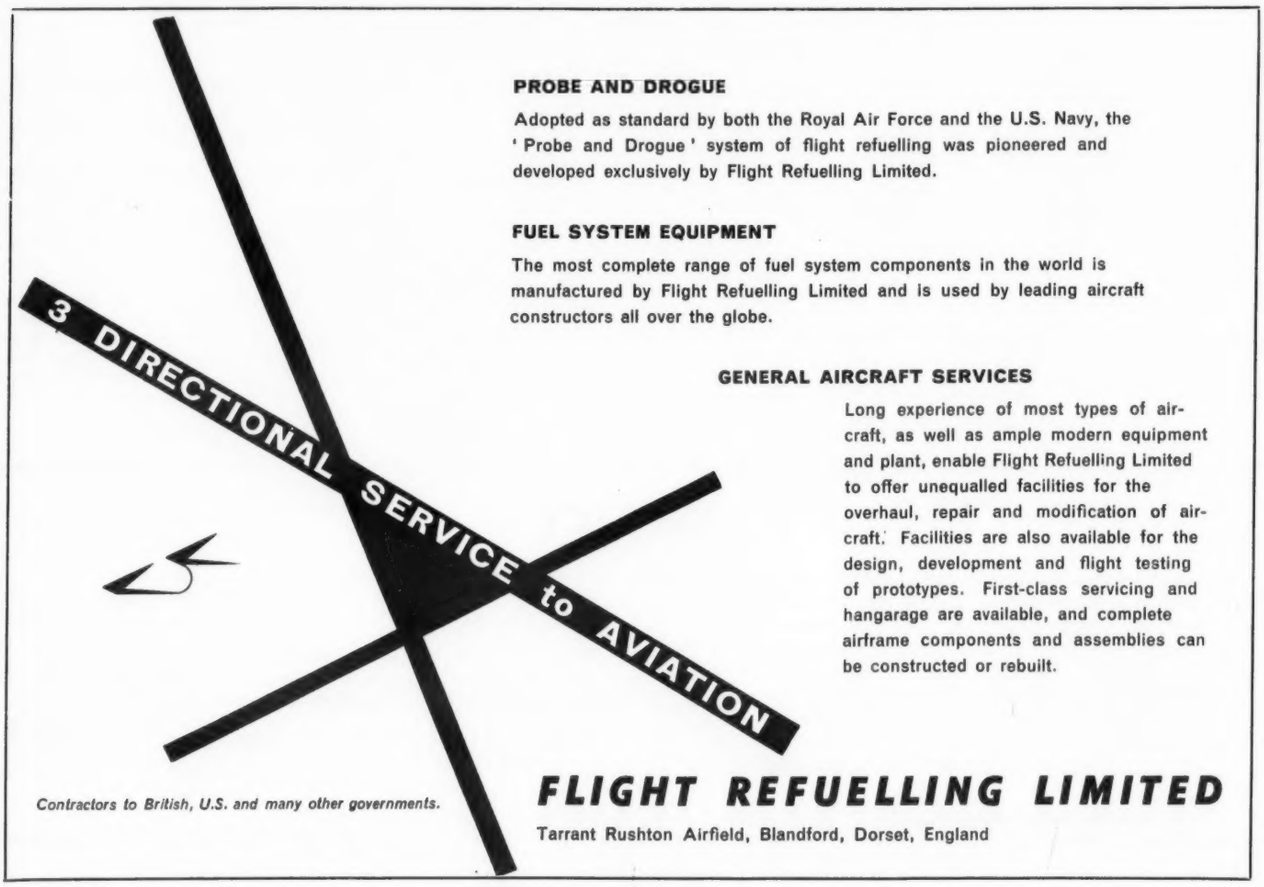
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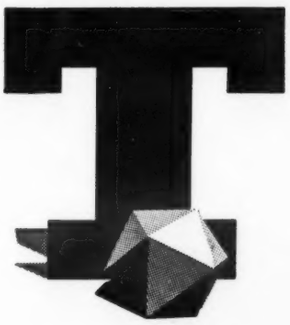

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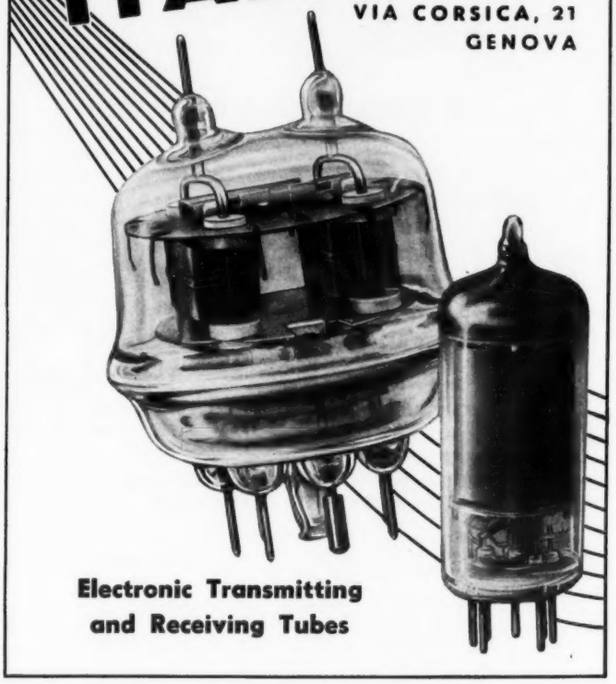

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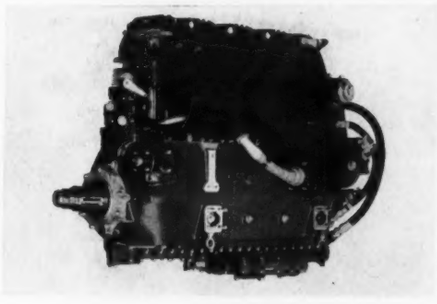

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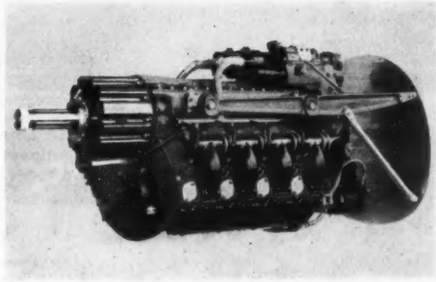

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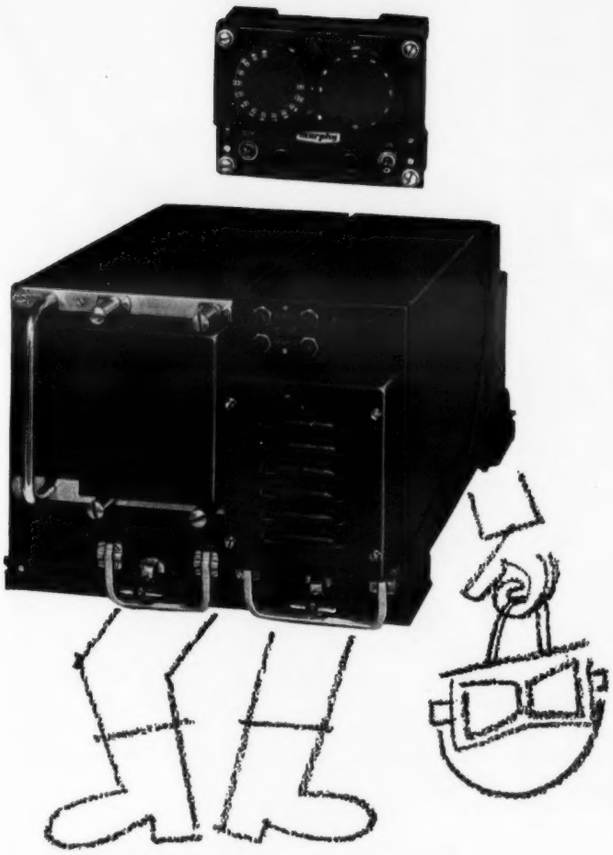

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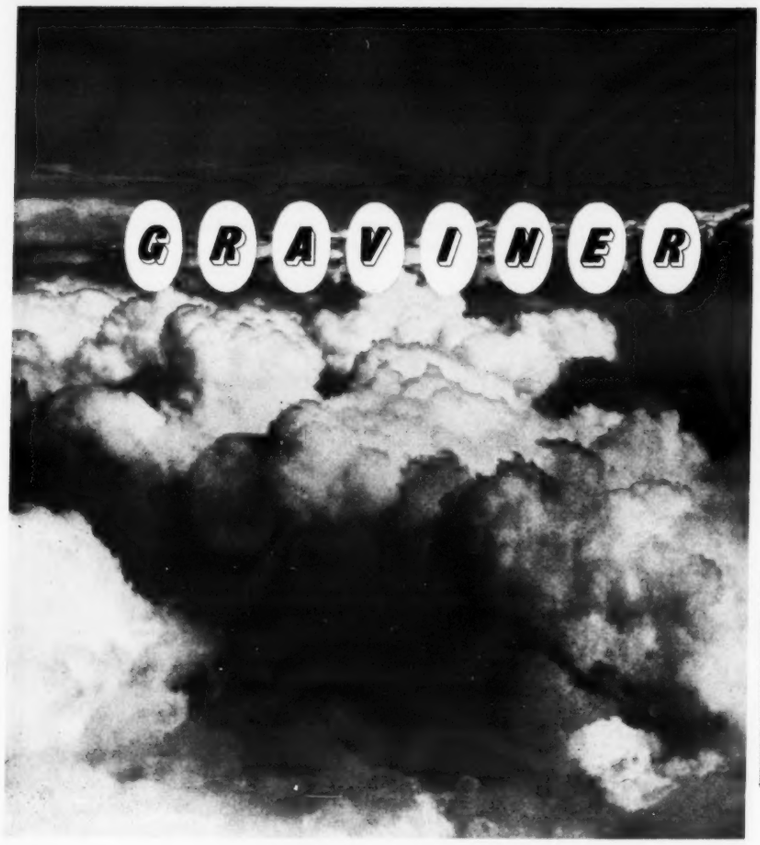

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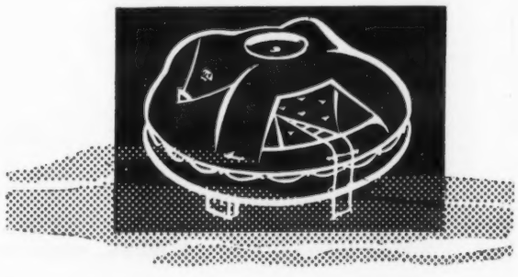

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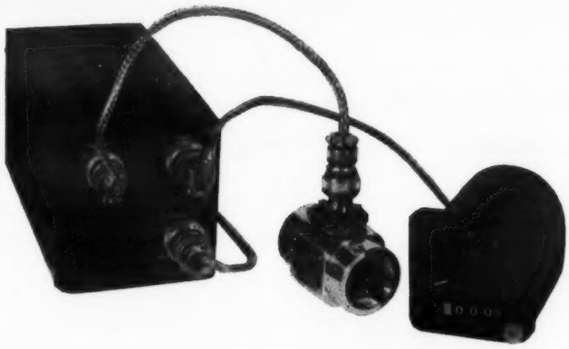

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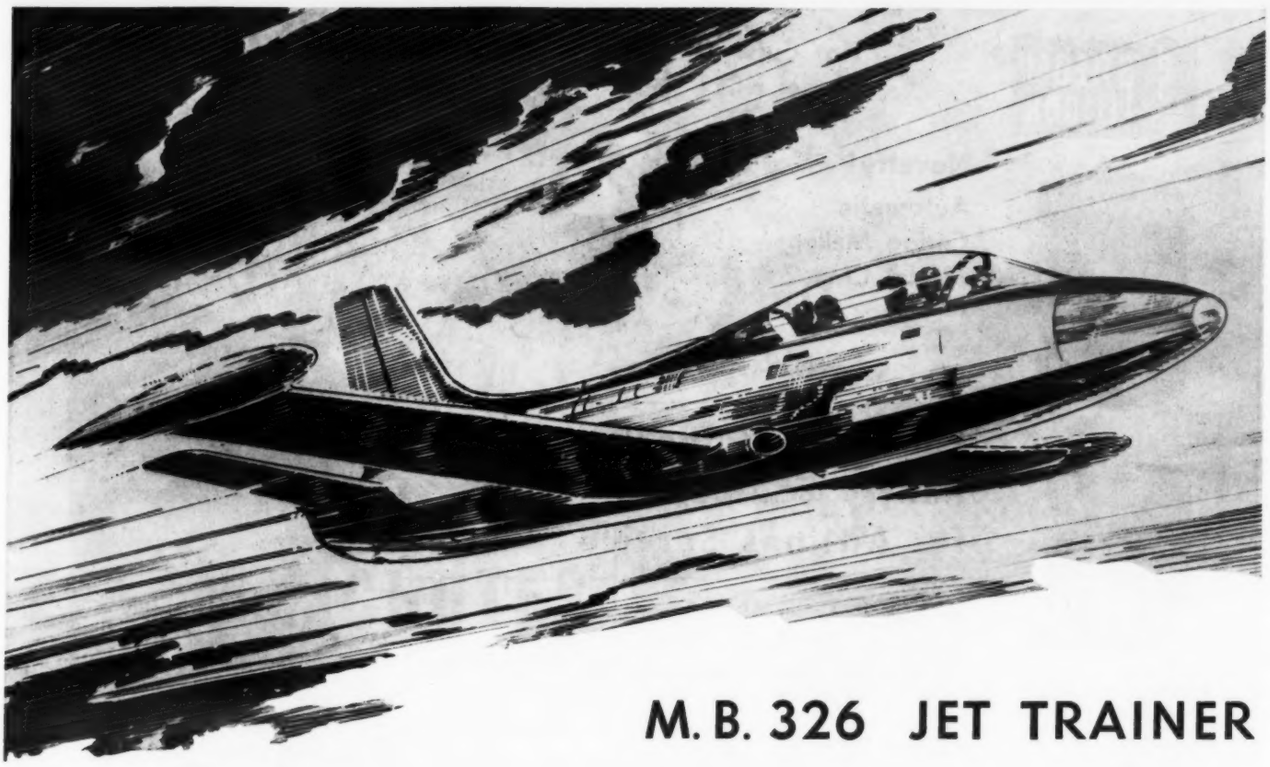

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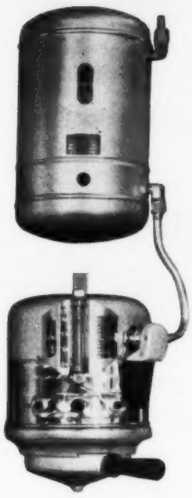

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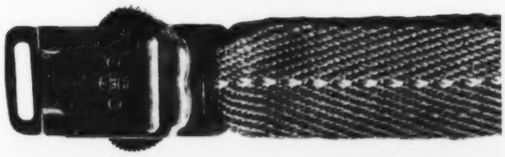

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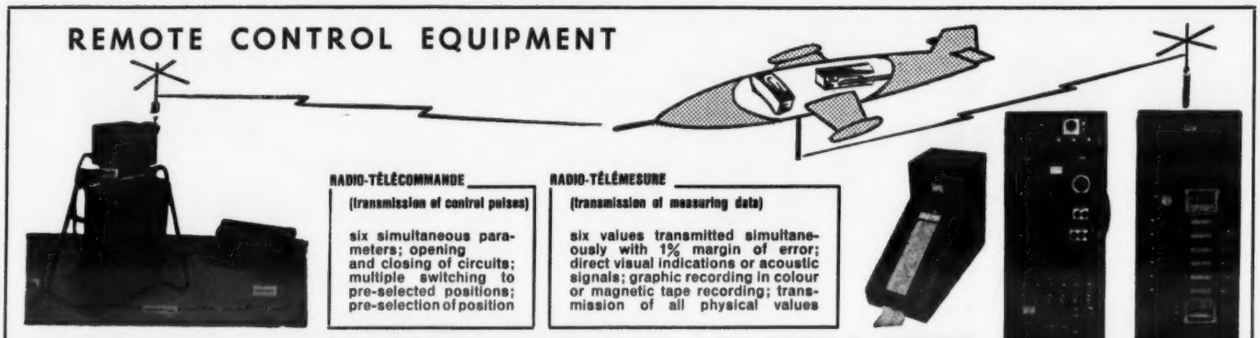

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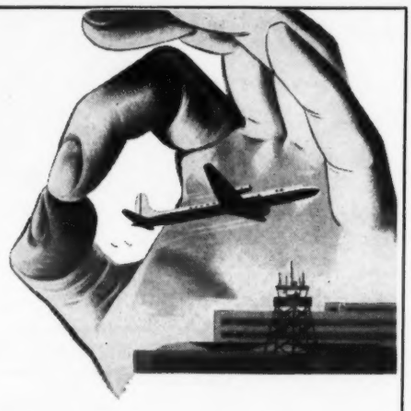

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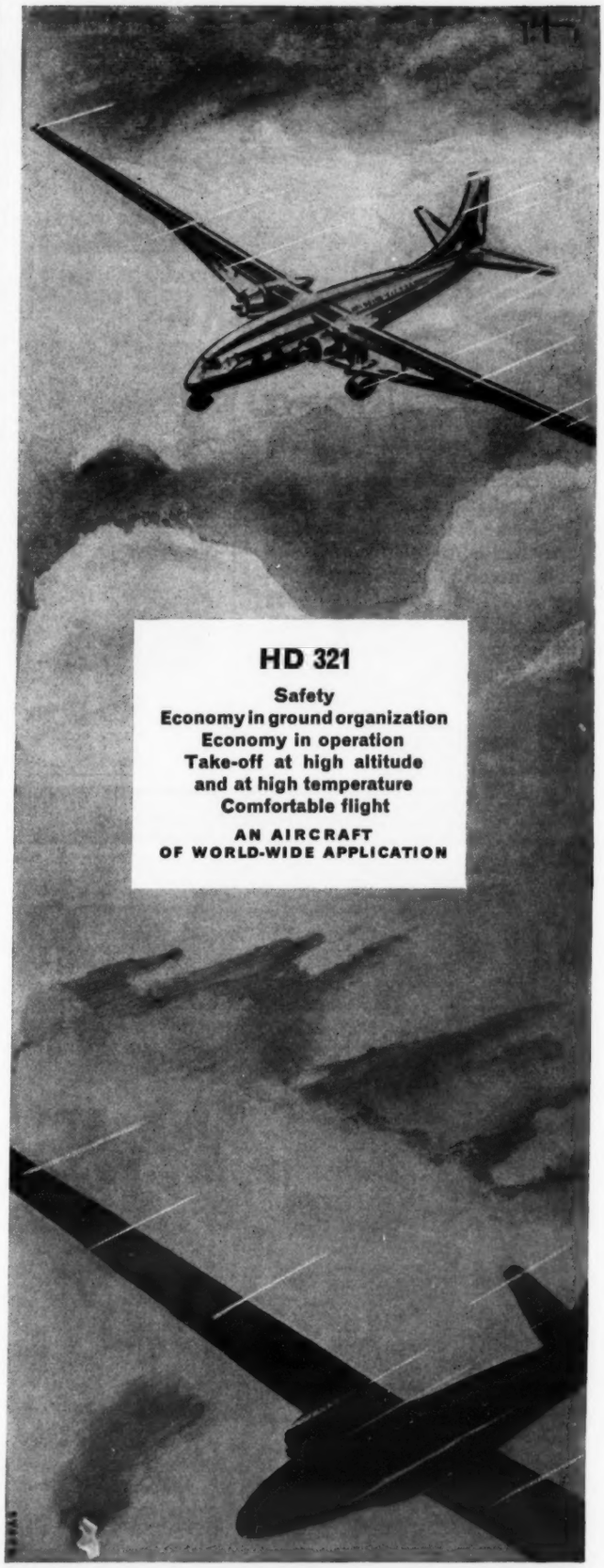

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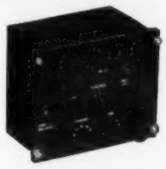

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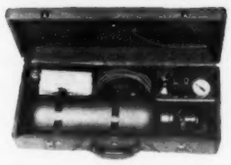

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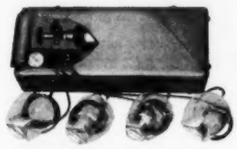

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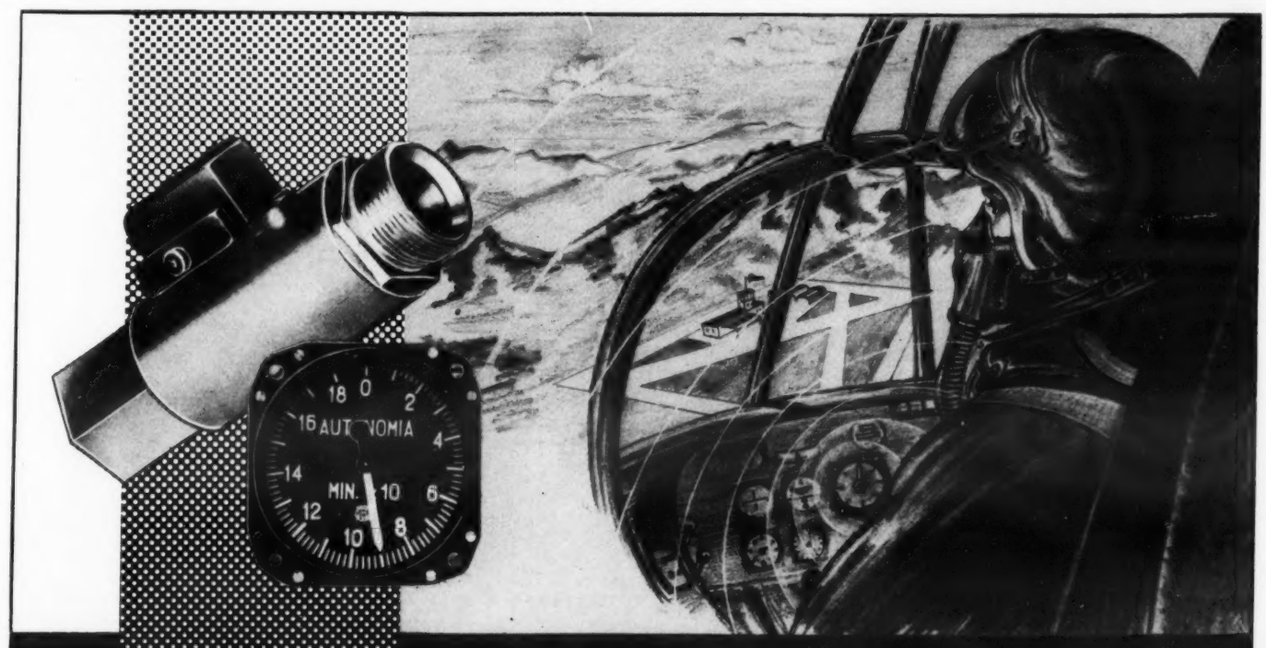

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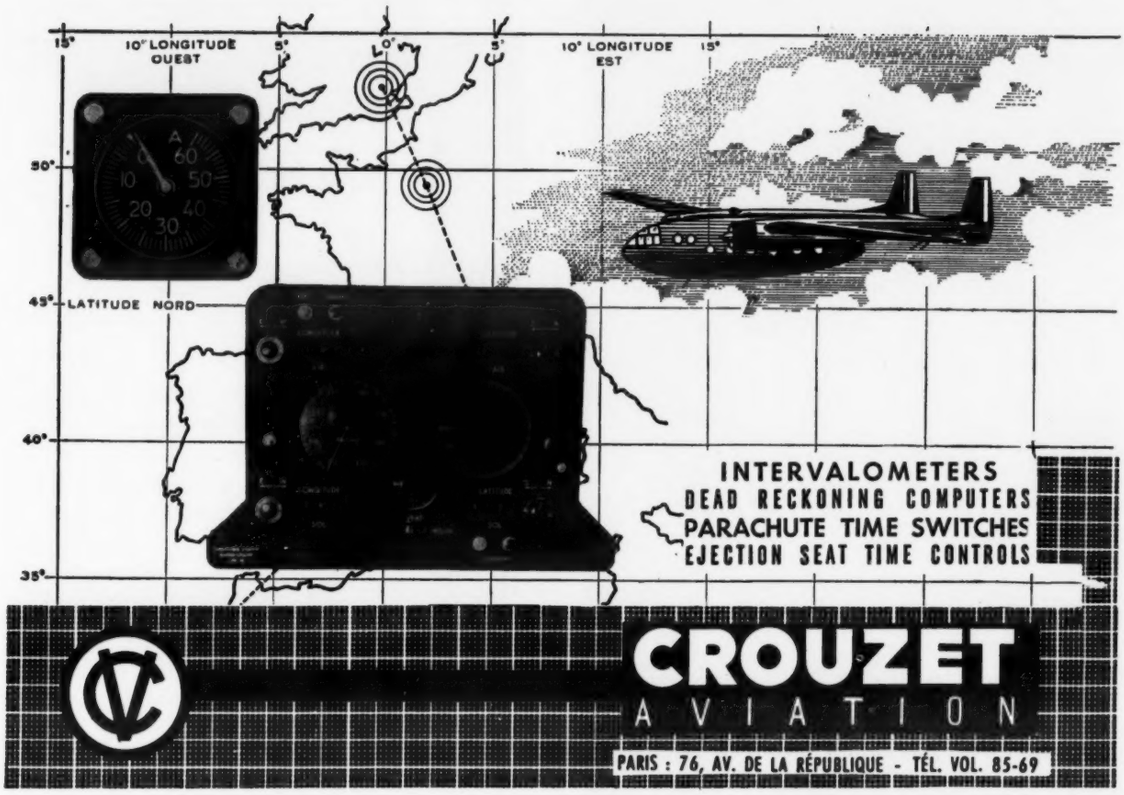
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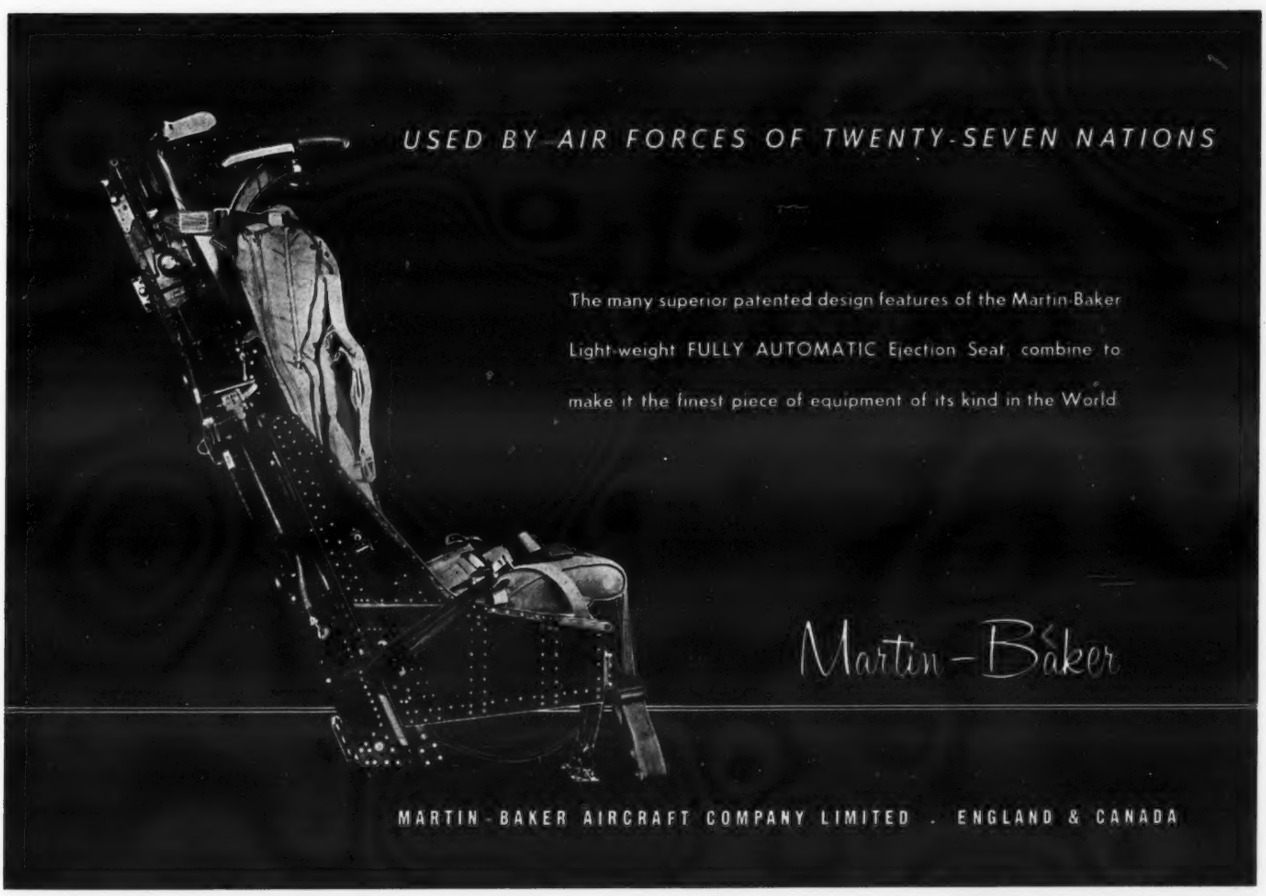
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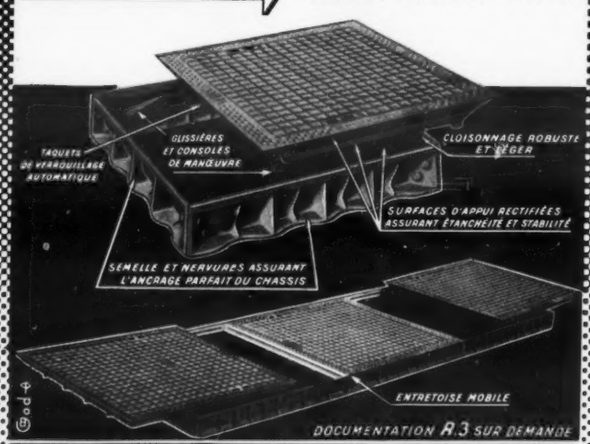
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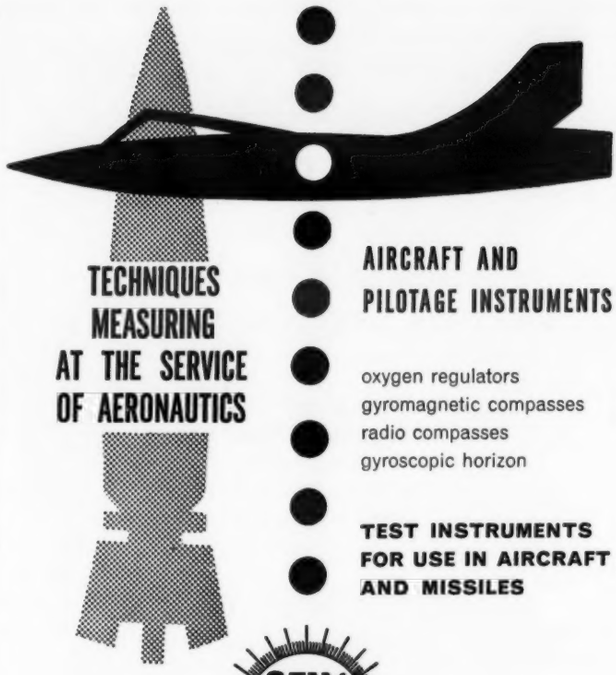

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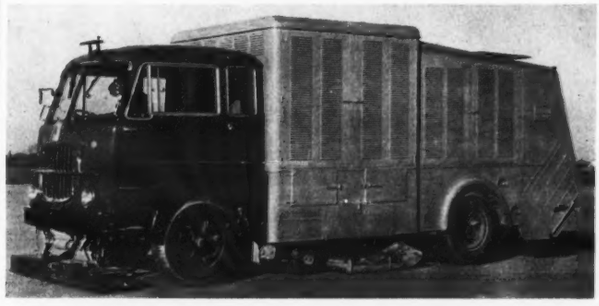

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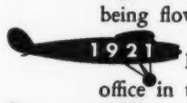
1919 - KLM is founded at The Hague, Holland, - the *oldest* air company in the world still flying under the same flag.

KLM inaugurates the Amsterdam-London flight which is the *oldest* air route in the world still being flown by the same carrier.

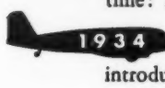


KLM opens the *first* air traffic booking office in the world.

KLM is the *first* to make use of air-cooled engines and all-metal propellers.

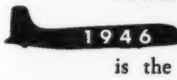
1927 - KLM makes the world's *first* intercontinental charter flights.

KLM opens the *longest* air route of that time: Amsterdam-Jacarta.



KLM, as the *first* airline outside the U.S.A., introduces all-metal Douglas DC-2 and wins the London-Melbourne Air Race. Two years later KLM is the first European company to buy the DC-3.

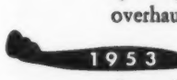
1943 - KLM, as first non-U.S.A. carrier, orders the Lockheed Constellation.



KLM, though heavily shattered by the war, is the *first* European airline to open a post-war North Atlantic service.

1948 - KLM is the first European airline to buy the Convair Liner.

1950 - KLM is the first European airline to be specially authorized by the U.S. Government to overhaul aircraft of U.S. air companies.



KLM is the world's first airline to operate the turbocompounded Lockheed Super Constellation.

1956 - KLM is the *first* carrier outside the U.S.A. to order the jet-engined Douglas DC-8 and the turboprop Lockheed Electra.

KLM
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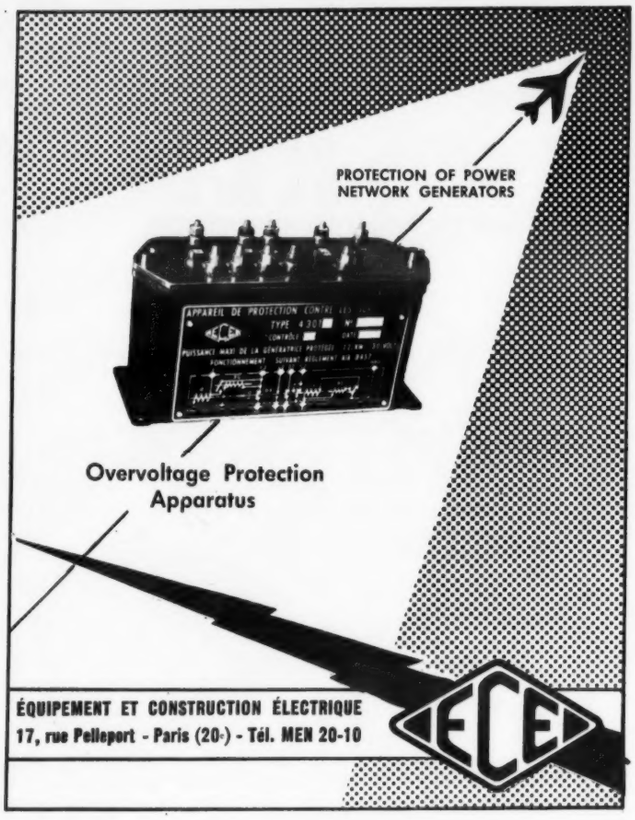

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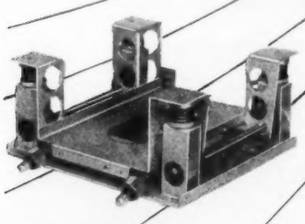

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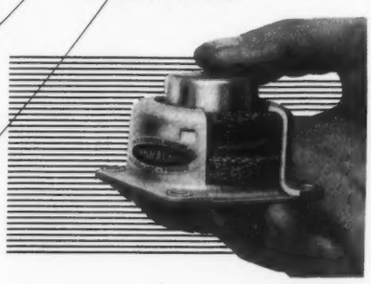

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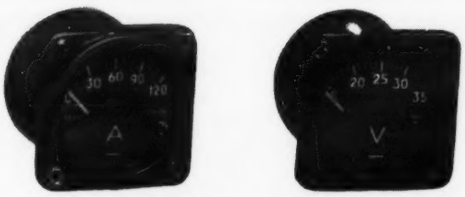

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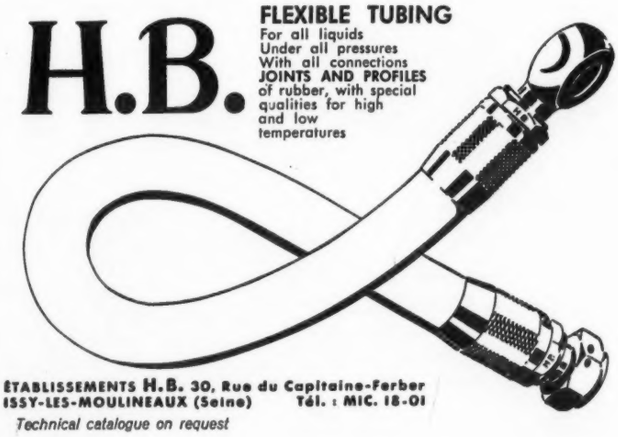

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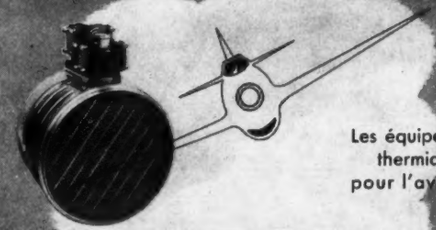

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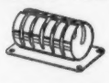

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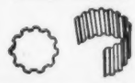

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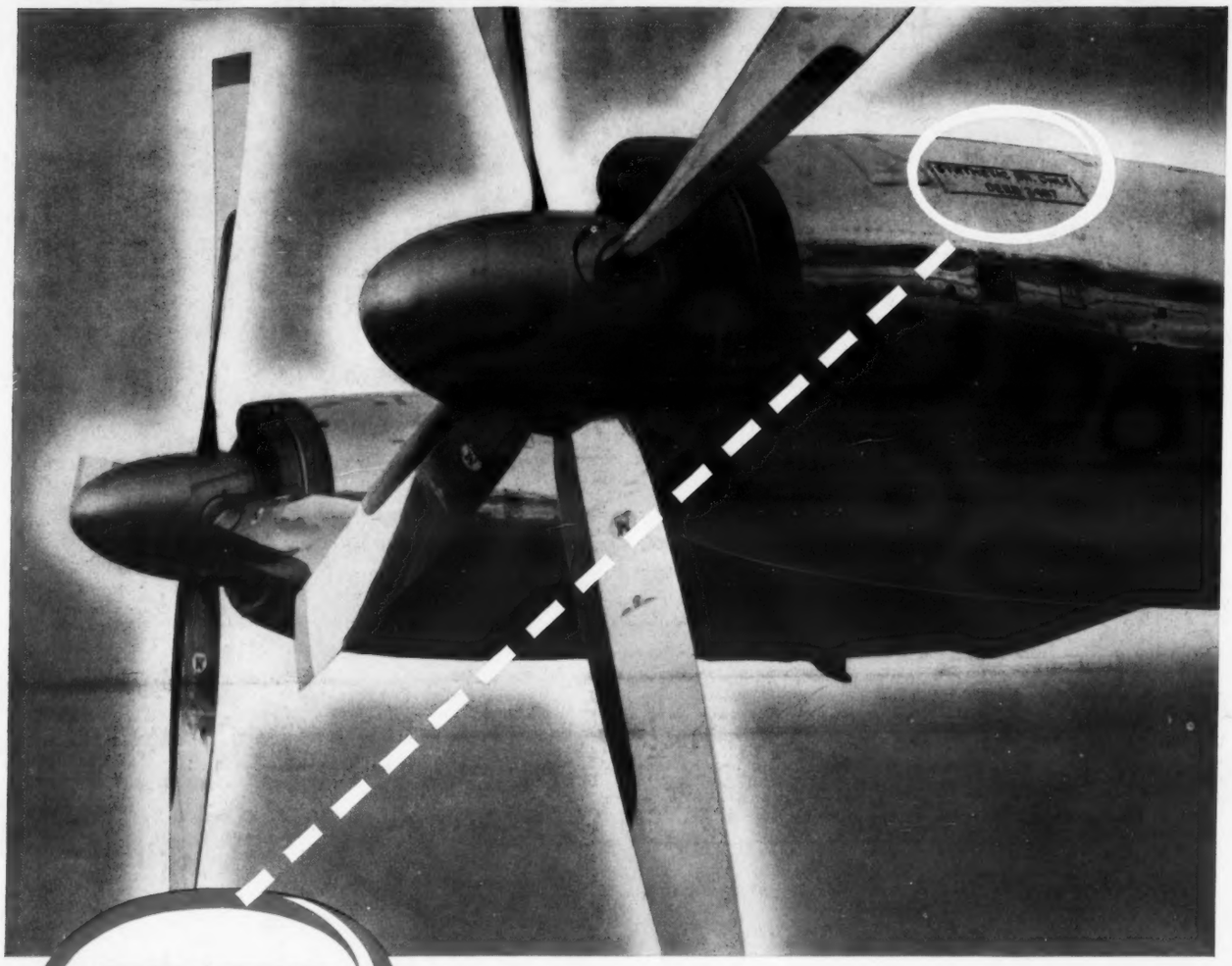

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